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EDITORIAL NOTES.

Central Organization.

THERE is a rising hope that at length something will be done towards establishing a real, effective, and representative central organization in connection with the gas industry. But it will greatly depend how the work is set about, as to what will be accomplished. We have never wavered from our conviction of some years ago that such an organization is necessary; and it was never more necessary than at the present critical time. But those in the gas industry—the administrators and controllers of the finance of the industry, those engaged in the manufacture of plant and appliances, or those holding official place in its technical, managerial, and commercial work—who desire that the interests of the industry shall rise above obstructive petty jealousies, must bring their influence to bear in urging forward the consideration of this matter. Otherwise, it is fairly certain that history will repeat itself, and nothing will be done.

It is necessary to say this, because, from the tenor of private communications received during the past few days, it seems that our article of last week has given, in some administrative quarters, the impression that a scheme of organization having comprehensive representation is actually under preparation; and this is apparently the view, too, of Mr. E. A. Harman, a letter from whom appears in our "Correspondence" columns this week. The matter has not got to that stage yet. We wish it had. Therefore, it will not do to sit composedly by, and think that something is already well on the road to maturity. To certain readers further north, we should like to repeat the opening words of our article last week: "Rumours have been "current the last few weeks as to the question of better, "more effective, and more comprehensive central repre- "sentation for the gas industry being again forced to the "surface." Later on, too, in the article, after expressing the view that it was not astonishing that the matter had again come forward, especially at this momentous time, these words were employed: "Nor is it surprising that the "administrative, financial, and commercial elements of the "industry—and they are anything but negligible quanti- "ties—are showing signs of insisting upon a proper recog- "nition and a proper place in the central work of the "industry. We do not blame them." That is the whole position, from which we hope that something really good will issue. We cannot say more at the present time.

Another reason why those concerned in the administrative, financial, and commercial work of the industry who are dissatisfied with the indifferent central representation of industrial interests that exists, should make themselves promptly and definitely felt in this matter is that already, since the article in last week's issue appeared, we have had the question put to us, by one interested in an existing organization, as to whether the present is an opportune time for dealing with the matter. Always procrastination! We repeat that never was time more opportune. Never was the necessity greater—this apart from publicity work—for a strong, comprehensive, and influential organization to represent, defend, and promote in several ways the interests of the industry. And after the war, too, the need will be felt acutely.

We will not pursue the matter further this week, but will put to the Council of the Institution of Gas Engineers one question, prefacing it with the remark that, upon the formation of a strong central organization—embracing administrative, financial, technical, commercial, and manufacturing interests—there would be no need for the Institution to discontinue its existence and work as a purely technical body. The question that we wish to put to the Council of the Institution is this: "Supposing that you again fight "shy of the central representative organization question, "what is to prevent certain others taking the matter up, "establishing what is necessary, and ignoring altogether "the existence of the Institution as a body?" It must be remembered that there are not a few members of the Institution who are in favour of a central organization for the whole industry.

The Pre-War Gas Returns.

THERE are now before us the Board of Trade gas undertakings' returns for the last complete year preceding the war. Those that will immediately succeed will deal with the working history of statutory gas undertakings under war conditions; and those that will follow them will disclose the results of operations under the conditions that are now being evolved from the state of war. Returns issued the next few years should therefore be permeated with special interest. Those to hand are in their results of normal character, and they cover, generally speaking, a normal period, other than that coal was dear (we wish it were no worse now)—the coal that was being used being mostly that contracted for immediately after the great coal strike. This shows how late in making appearance are the newly issued returns. It is just over two years since the last ones were received; the delay being no doubt due to a variety of causes—principally pressure in Government departments arising from the war. We must not complain; and there would be very little use in doing so. Through the war, and the paucity of Private Bill gas legislation, little has been lost by the non-appearance of the returns; but we do hope, while appreciating the heaviness of the work of compilation, and the difficulties of the times, that an effort will be made, as early as possible, to retrieve the lapse, and bring the issues to within (say) nine or ten months of the close of the local authorities' financial year, and a year or so of the close of the companies' year. This condition was once reached; it forms a very good standard for the department to work to, seeing that the value of the returns is enhanced by keeping as close as possible to the period to which they refer.

The present returns deal with the year 1913 in relation to statutory companies, and with the year ending March, 1914, in relation to local authorities. Some valuable changes have been made in the information given, and on these the compilers must be congratulated. It is observed that on this occasion, in the case of undertakings with water-gas plants, not only is the maximum proportion of water gas mixed with the coal gas given, but the average figure is also supplied. This is useful; and it does better justice to the concerns than the maximum alone. Then a fresh entry has been effected in the "Coal Gas" and "Water Gas" made column. Coal gas and water gas are respectively designated as heretofore "*a*" and "*b*;" but now "*c*" stands for "other gas." The total of "other gas" in the case of the companies reaches 4,907,696,000 cubic feet. This is a somewhat remarkable figure; and search leads to the discovery that no less than 4,846,950,000 cubic feet of this is represented by the return of the South Staffordshire (Mond) Gas Company, whose figures have hitherto been included in the coal gas made for ordinary use. This fact and the tonnage of coal used have in a limited degree vitiated the calculations hitherto made as to the quantity of gas produced per ton. However, the change will in future enable avoidance of this comparatively small error. The balance of the "other gas" for companies consists of 60,746,000 cubic feet of "oil gas" entered up to the Newport (Mon.) Gas Company. This indicates the possibility of an error through the objection of some gas engineers to the use of the cumbersome term "carburetted "water gas," and preference for the use of the term "oil "gas." Unless there is some special reason for this quantity of gas being called "oil gas," we suggest that the proper place for it is under "*b*." The suggestion may, of course, be wrong; but perhaps we shall hear whether or not it is so. The "other gas" in the case of local authorities is interesting. It only totals to 4,293,000 cubic feet. Birmingham makes a very large return under "*b*" for carburetted water

gas; and under "*c*" oil gas is entered to the amount of 3,451,000 cubic feet. Manchester makes a return of 536,000 cubic feet for "benzol vapour." These special makes are, of course, for enrichment purposes. Then there is the little undertaking at Ellon, in Aberdeenshire, doing business in oil gas to the extent of 197,000 cubic feet; and that at Portsoy supplying acetylene gas to the amount of 109,000 cubic feet. To the compilers of the returns, it may be suggested that a "*d*" should next be added, so as to keep, *ab initio*, a record of the purchase by gas undertakings of coke-oven gas.

In other columns of the returns analysis is now made of the consumers, and of the consumption of gas; and the prices charged for gas for different purposes are also set out. These changes, the figures being official ones, will be extremely useful. It is seen that the number of prepayment consumers in the United Kingdom is in excess of that of ordinary consumers—the respective figures being 3,770,329 and 3,332,784; but in another column where now the consumption is separated as between ordinary and prepayment consumers, public lamps, and bulk sales, it is seen that ordinary consumers took of the total quantity of gas sold 145,727,648,000 cubic feet, while the greater number of prepayment consumers had their requirements satisfied with 49,944,844,000 cubic feet. The public lamps consumed 10,801,981,000 cubic feet. The figures showing the relation of the ordinary to the prepayment consumption are remarkably interesting; and they, with the public lamp consumption, make the 206,474,473,000 cubic feet given in the final table as the total quantity of gas sold. This figure, however, fails to account for the 629,276,000 cubic feet sold in bulk, which would raise the total sold to 207,103,749,000 cubic feet. There are some other changes; but we have indicated the ones of major importance.

In making comparisons, although the returns for statutory companies apply to the complete year 1913, and for local authorities to the year ending March, 1914, we will, for the sake of ease, refer to the period as 1913-14. Generally speaking, the figures show good progress in gas business, and a continued advance in coal economy in relation to output. But, as will be seen presently, the additional receipts were about a million pounds sterling short of the increase in expenditure, which condition recollection at once attributes to coal prices, the market values of residual products, and reductions in the price of gas. Treating first of manufacture, the total quantity of gas made in the year was 224,517,107,000 cubic feet, of which 195,826,569,000 cubic feet were coal gas, 23,778,609,000 cubic feet water gas, and 4,911,989,000 cubic feet "other gas." The total gas made was 9,024,453,000 cubic feet in excess of that for the preceding year. If we assume a make in 1912-13 of 4,500,000,000 cubic feet of "other gas," and deduct this from the coal gas (in view of the make of the South Staffordshire Mond Company), it is found that the 1913-14 make of coal gas exceeded that of 1912-13 (183,851,688,000 cubic feet) by 11,974,881,000 cubic feet; while the make of water gas was less than that of 1912-13 (27,141,026,000 cubic feet) by 3,362,417,000 cubic feet. The difference between the increased make of coal gas and the decrease in the quantity of water gas produced has to be supplemented by the difference in the actual figure for "other "gas" in 1913-14, and the assumed figure for 1912-13 to arrive at the increase of 9,024,453,000 cubic feet in the total amount of gas made. In 1913-14, the total quantity of coal carbonized was 16,971,724 tons; and, deducting the Mond consumption of 59,013 tons, we have 16,912,711 tons, the make of gas from which averaged 11,578 cubic feet per ton. In 1912-13, 16,052,487 tons were used, of which 48,853 tons were consumed by the Mond Company—leaving 16,003,634 tons. Taking the before-mentioned revised figure for coal gas of 183,851,688,000 cubic feet, the average make per ton in 1912-13 was 11,488 cubic feet; so that 1913-14 gave an average increase of 90 cubic feet per ton. Mutiplying the 16,912,711 tons of coal used by the 90 cubic feet, we have an additional make from the coal used of 1,522,143,990 cubic feet, which shows that, if the 11,488 cubic feet yield of 1912-13 had been continued, 132,500 tons more coal would have been required in 1913-14. Instituting backward comparison, Professor Bone would find in the gas industry some interesting lessons in "fuel economy" in relation to gas production.

Coming now to general figures, the gas undertakings making returns numbered 831—viz., 519 companies (— 1), and local authorities 312 (+ 6). The capital authorized amounted to £162,346,673; being an increase of £1,093,132. The total amount of capital paid up and borrowed was £139,727,277; being an advance of £2,265,307. The total income of the 831 undertakings was £35,503,558; being an addition of £1,235,188. But the expenditure of £28,242,104 was higher by £2,211,925, so that the gross profit was less by £976,737. The quantity of gas sold was 206,474,473,000 cubic feet—an increase of 7,552,004,000 cubic feet. The mileage of mains was 39,099—an extension of 1355 miles, which indicates a continuation of the process of penetrating into outlying areas. The number of consumers was raised by 7,103,113—the enlargement being 226,964. Dividing the total quantity of gas sold by the number of consumers, the average for 1913-14 is 29,068 cubic feet, as compared with 28,929 cubic feet in 1912-13, which is a move in the right direction. The number of the public lamps (741,700) increased by 6579. Thus the progress in the gas business during the "returns" year was good; the only black spot being the reduction of gross profits through the causes mentioned in the early part of this article.

Arsenical Sulphuric Acid and Sulphate Making.

THE present inadequacy of sulphuric acid has imposed awkward difficulties upon makers of sulphate of ammonia. Not only is the best quality of acid required in connection with the manufacture of high explosives, but the extraordinary absorption for this purpose and other industrial needs is supplemented by the inability to now obtain the nearly arsenic-free Norwegian pyrites for making acid; and so perforce there has to be large contentment, in the absence of more complete sulphur recovery from gas in this country, with the heavier arsenic-charged pyrites of Spain and Portugal. It is useless to kick against the position, though there might be some effective steps taken to improve it. Meantime the alternatives are arsenical sulphuric acid and nitre cake, or the sacrifice of ammoniacal liquor, which course cannot be entertained. There are difficulties and objections to the employment of arsenical acid and nitre cake; but on this occasion consideration is only directed to the question of the use of the former. The arsenical variety of acid is not liked, principally on account of the discoloration of the sulphate of ammonia by the association with it of the sulphide of arsenic formed in the saturator by the precipitation of arsenic by the sulphuretted hydrogen. Users are strongly averse to the purchase and application of sulphate of ammonia that is of bad colour; and if they are so when the material is at a lower market price than now, they will be more so with the price where it stands to-day. There are also doubts as to whether or not the arsenic in the sulphate has some biological ill-effects in agriculture. *Primâ facie*, we should agree with the opinion indicated by Mr. P. Parrish, in an article in other columns, that there is not any substantial ground for fear that a trace of sulphide of arsenic in sulphate has any deleterious result from the manurial point of view. He does not put this opinion forward as positive; but what else can be inferred from the known fact that considerable quantities of superphosphates are made by the aid of arsenical acid, and sold and used in this country, without being accused of harmfulness. In the face of such experience, it would, indeed, be a singular thing if a trace of sulphide of arsenic in sulphate were injurious. On the contrary, it was put forward the other day, from another quarter, that a small percentage of arsenic in the sulphate would have a beneficial effect rather than otherwise. However, the matter is one that has not been definitely settled; and, as the Board of Agriculture have voted sums of money to the purposes of research, they might with advantage have this question investigated.

But we suppose it is due to the lack in some minds of appreciation of proportion in things, or perhaps to the heavier weight attached to a visible defect than to a known but invisible one (though the latter may be actually the more serious of the two), that most purchasers appear to place more importance on the bad colour of the arsenical sulphate than upon the undetermined question as to any hurtful effect the latter may have in use. The objection to the discoloration by sulphide of arsenic has to be dealt with; and Mr. Parrish discusses the means by which the trouble may be effectually remedied, and the working hints that he supplies will be found very valuable by those who have not previously been faced with this particular problem in their working. In their sulphate manufacturing operations, the shale distillers use arsenical B.O.V., and partially eliminate the arsenic by using a film of anthracene or other suitable

oil in the saturator. But the result in colour is not all that could be desired, though really there is nothing in it for genuine complaint. In closed saturators working with an automatic or self-scumming arrangement, an appreciable scum of tarry matter is continuously discharged ; and when using an arsenical acid in such a saturator, the sulphide of arsenic formed in the bath becomes intermingled with the tarry matter, and is removed. In this case, Mr. Parrish discountenances the use of an oil film. The third process, and the one recommended, for the removal of the arsenic from the acid is that known as dearsenication. Although the process is not a difficult one if proper precautions be taken (and to which precautions direction is given by Mr. Parrish), little information has been published as to practical experience concerning it. It has had very little application to the gas industry, but more in connection with coke-oven working. Probably the sole cause of a dearth of information on the subject from the latter source has been due to the absence until lately of a technical organization before which matters of the kind could be discussed. The process is quite a feasible one ; and the plant (Mr. Parrish describes the type that he recommends) is simple, and so are the methods. If the working principles advocated by the author are adopted, the best results in dearsenicating acid will be achieved. It may be taken that, in ordinary circumstances, in the waste gases from the distillation of the ammoniacal liquor, there is an abundance of sulphuretted hydrogen for the precipitation of the arsenic, although, of course, the composition of the waste gases differs with the composition of the liquor distilled. For determining the size of the dearsenicating plant required, it is necessary to have some data for guidance ; and their realization is, as indicated by example in the article, a very easy matter.

However, there would be in both normal and abnormal circumstances more dearsenical acid available for the country's needs if there was not such a ruthless waste of sulphur as now proceeds, especially at coke-oven plants. It will be seen that Mr. Parrish computes that, if 80 per cent. of the gas produced at coke-ovens were subject to oxide purification for sulphuretted hydrogen, there would be available approximately an additional 25,810 tons of sulphur. When sulphurous materials are so short of the need, this is a scandalous waste ; and our contributor thinks that the attention of the Ministry of Munitions ought to be drawn to the matter, in order that steps may be taken to rescue this valuable material for the service of the country. He goes even farther than this, by suggesting that the Ministry of Munitions should also, after reasonable notice, forbid the elimination of sulphuretted hydrogen by lime, and enforce the removal of compounds other than sulphuretted hydrogen by the Carpenter and Evans heat process of purification, so that the sulphur might be removed in useful form. We are afraid refined purification as represented by the latter system would have to be a matter for subsequent consideration so far as coke-oven plants are concerned, and that purification, if made compulsory during the period of the war, would have to cease at the oxide purifiers. At any rate Mr. Parrish has made a suggestion, upon which it would be interesting to know the respective views of the Ministry of Munitions and the managers of coke-oven plants. We know that the thin end of the wedge of oxide purification of gas has been inserted in coke-oven practice, where gas is used for power purposes, owing to the deteriorating effect of the sulphur-laden gas on the engines; but when sulphuric acid is so much required, it does seem, and is, an unpardonable waste of sulphur not to subject the gas to oxide purification, which is such a remarkably cheap process.

Gas for Industrial Canteens.

THIS subject, in a limited sense, is not a new one for gas undertakings. There are gas-works that have for years had their own canteens or kitchens with mess-rooms attached —provision being made for the supply of good wholesome plain dinners at cheap rates, and for cooking and warming food brought from home by the men. And from this, great advantages have been derived. The physical condition and general health of the men rank high ; and their habits, if not in all cases irreproachable, are improved by the conveniences and associations. We have often privately felt pity for men, whose occupations require the combination of a strong constitution, muscular energy, and intelligence, when, on severe winter days, they have been seen to sit down in uncomfortable surroundings to cold and heavy food brought from home. Fed under such circumstances, it is impossible to expect their efficiency and health to be constantly maintained. Much better conditions than these now largely obtain in the gas industry; but the very thing that gas undertakings have brought into successful application on their own account (to the benefit of themselves and their men), they have not, generally speaking, made any special effort to import into other industries. Now is a very favourable time to attempt to do this. There is considerable talk about raising the efficiency and the productivity of industries; and one of the factors to progress in these directions is the enhancing of the efficiency and the productivity of the worker. This is only to be accomplished through good health and capacity for physical endurance, both of which are promoted by the ability to secure well-cooked, nourishing food, at a reasonable price. That both employers and employees gain, is no unproved theoretical idea. It has been found true by practice in the gas industry; it was proved in some business establishments and in many factories before the war; and since the war started, it has been adopted as a necessary and effective means of assisting to develop maximum output in numerous national and other munition works. Maximum output is what will be required in most industries in the coming years of peace, if we are going to enjoy a larger part of the world's trade than heretofore, besides making this country more independent than ever before of enemy countries. All the circumstances considered, the tide runs well for the gas industry giving special consideration to the development of the industrial canteen and kitchen business in factories and workshops. An article on the general subject, with illustrations showing the substantial character of the work to be done, appears in other columns; and it contains suggestions which will be useful in the efforts made to promote this branch of business. As is stated in the opening of the article, the industrial canteen and kitchen have come to stay; and it is a line of business that should be the gas industry's own. If it is to be so depends upon every gas undertaking with substantial factories in its supply area, and the workers at which live some little distance away, doing its part in developing the adoption of canteens or kitchens.

A Display of Ignorance in Australia.

THE "Melbourne Age" is probably the most influential paper in Australia; and, in view of this, we are extremely sorry to see, in a recent issue, a leading article on the question of fuel economy which, to put it mildly, is one of the most egregious displays of ignorance that we have for some time had brought to our notice. The fact of the matter is the writer of the article, not having the technical capacity for investigating on his own account facts relative to his subject, has accepted as gospel assertions that not only amount to misrepresentation but to absolute falsehood through the suppression of important and essential facts. We are surprised that the "Melbourne Age" should have allowed itself to be the vehicle for the extension of the circulation of statements that are untrue, and should have drawn deductions from them that are absurd. Even ignorance of technical matters does not excuse a responsible public paper doing this sort of thing. The "Age" says "we have only to regard our gas supply in Melbourne to "see an example of how fuel may be wasted in methods "of illumination." The basis for this ridiculous statement is found later to be the Presidential Address of Mr. C. P. Sparks to the Institution of Electrical Engineers, which was noticed in the "JOURNAL" for Nov. 30 last (p. 473) and the succeeding issue (p. 529).

Accepting the bare declarations of this address, our Australian contemporary holds that considerations of economy demand that illumination shall be electrical, and not be produced by the burning of gas. We are amused. It grasps without any questioning the statement in the address that one ton of coal will give 260,000 candle-power-hours when gas mantles are used; it fails to say anything about what can be produced in illuminating value by the same 13,000 cubic feet of gas when used under high pressures. With modern generating stations, and metal filament lamps, it says that 750,000 candle-power-hours can be obtained from a ton of coal. This, of course, is an exaggeration; the figure should be nearer 596,800 candle-power-hours. Upon this the "Age" remarks: "The complete displace-"ment of gas lighting by electric lighting is therefore some-"thing which we must insist on carrying out in the near

"future." This is extremely kind. But if our contemporary looks a little beyond its nose, it will probably, in the cause of fuel economy, soon be convinced that its imperative mission in life is to urge that electricity generating stations shall be promptly abolished, and that no coal shall be used excepting in gas-works.

Now when considering the fuel economy of the gas industry in relation to the fuel waste of the electrical industry, the leader writer of the "Melbourne Age" could not do better than regard the question from the thermal standpoint, because illumination is only one thing that results from the carbonization of coal by the gas industry. If he takes coal with a calorific power of 14,000 B.Th.U. per pound, he would find a ton of it would have a thermal value of 31,360,000 B.Th.U. If this ton of coal were consumed in a modern turbine electricity generating station, about 746 units of electricity would be generated, but from this figure there are the distribution losses to be deducted. The 746 B.Th.U., at 3420 B.Th.U. per unit, are equivalent to only 2,551,320 B.Th.U.—that is to say, nearly 29 million B.Th.U. have been lost in the process of generating the electric current. Now gas undertakings have never been so foolish as to adjudge the value of their coal expenditure on illumination product alone; they leave that course to be taken by the President of the Institution of Electrical Engineers. Gas undertakings are purveyors of something more than gas for illumination purposes. Suppose a make per ton of coal carbonized of 12,500 cubic feet of gas having a value of (say) 500 B.Th.U. per cubic foot. This is equal to 6,250,000 B.Th.U. per ton of coal. Then there are produced about 10 cwt. of coke, which has a calorific value somewhere in the neighbourhood of 13,000 B.Th.U. per lb., equal to a total of 14,560,000 B.Th.U. for the 10 cwt. of coke. Therefore in the gas-works from gas and coke alone nearly 21 millions of the B.Th.U. of the original ton of coal have been recovered in the process of carbonization. The tar and pitch, too, that are made have a calorific value of about 10 per cent. of the total heat value of the coal. The tar has considerable value as the raw material for chemicals, dyes, high explosives, &c. From the ton of coal, too, about 28 lbs. of sulphate of ammonia are made. There is another point. From the coke, water gas can be manufactured; and thus the make of gas be very largely supplemented per ton of coal carbonized.

Upon this statement of facts which the "Melbourne "Age" can readily check for itself, we should like to know what it really means by the statement it makes that "the "complete displacement of gas lighting by electric lighting "is therefore something which we must insist on carrying "out in the near future." Having "insisted" on the change in the near future, how is this going to help fuel economy? Our contemporary, taking the same authority for its guide, suggests that the future of electricity generation must be by the aid of low-temperature gas-producer plants. Of course, it does not know that for considerable generating units, there is nothing to beat the steam-turbine; it is only in smaller generating sets where the internal combustion engine can in over-all economy at present beat the steam-turbine. It is a great pity that the "Melbourne Age" has indulged in such random writing, and thereby testified to those capable of technical judgment that sheer ignorance is responsible.

Externally Heated Gas-Ovens.

When in the public Press a writer starts criticizing the efficiency of the gas-oven with interior gas-jets, and applauds as economical and efficient the externally heated oven with closed bottom, it is time that gas-cooker makers and gas engineers began to look a little more narrowly into the matter, to ascertain whether improvement can be effected on the old pattern of construction. Work has been done in this direction, and externally heated ovens are available; but generally the virtues claimed for them are neglected. This is a mistake. If there is anything worth having in the new types, gas engineers should make their intimate acquaintance; for, sooner or later, public information on the subject will grow, and a new demand is bound to spring up. Better is it that this should be recognized early and voluntarily than later and compulsorily. The Engineering Correspondent of the "Daily Telegraph" has published an article on the question; and he is much taken with the idea of the externally heated oven as compared with the internally heated one. He is not a gas engineer, and is disinterested as between the one type of oven and the other; but as his views are those of a technically trained "outsider"—that is to say, outside the gas industry—they are worth consideration. The new construction of oven that he has in mind is akin to that of the Potterton "Sealed" and Miss Edden's "1915" cookers. These cookers the electrical people do not like, as they divest them of some of their pet arguments against the gas-cooker—however ridiculous their arguments may be. The writer in our morning contemporary seems to view the internally heated gas-oven as a piece of defective apparatus; and he says that "it is up to the gas engineer to make good the defect, and introduce cookers which shall stand unrivalled by the newer devices of any competing system of cooking."

The Criticism, and a Suggestion.

We are pleased to observe that the Engineering Correspondent does not fall into the absurdity of referring, as have so many electrical engineers to suit their own ends, to the products of gas combustion—carbonic acid and water vapour—as noxious and food-contaminating fumes. The gravamen of his criticism is that the interior heated gas-oven is wasteful contrasted with externally heated ones. We cannot challenge his assertion that the same careful research has not been bestowed upon the gas-cooker as upon the gas-fire. But where in one respect he goes astray is in assuming that the principal waste is due to the oven rather than to the top boiling-plate. The relative cheapness of gas-provided B.Th.U. compared with any other labour-saving and convenient agents has been the cause of the adherence to the old principles of construction on the top ptate; and yet a very large percentage of the total gas consumed for culinary purposes is used in this quarter of the cooker. However, to the oven. Our friend is not hypercritical; but he says enough to show that he has given some thought to the subject. The open bottom oven, he says, is not ideal. "Large volumes of air are drawn in; and this excess of air is wasteful, in that it absorbs and carries away heat, and militates against high temperatures." We admit a certain crudeness; but it does not go so far as the critic imagines. The size of the oven vent really constitutes the regulator of the quantity of air passing through the oven; and if the critic had carried out heat tests, he would have been surprised at the height of temperature attained, the uniformity of temperature that can be maintained, and the range of temperature adjustment afforded by the simple gas-tap. His idea of making an efficient cooker is to burn gas in a small separate combustion chamber, in which the volume of air flowing through can be regulated, and to allow the hot gases to pass into the cooking chamber, to which all direct air admission is prevented by the closed bottom. The better way is that in which the gas is burned, with regulated air supply, in the enclosed space formed by the external and internal walls of the closed oven; the hot products of combustion being circulated round the internal oven casing. In this case, the burners are also protected from grease, the flames from draughts and dust, and economy and cleanliness are secured; and, further, those people who, from sheer ignorance, are opposed to food being cooked in an atmosphere in which the products of combustion of gas are found, have their whim gratified.

The Municipal Savings Banks Scheme.

When referring in last week's issue to the proposal made in Birmingham, at the instigation of the Lord Mayor, for the starting of a Corporation savings bank, as a special step to meet an abnormal condition of affairs, it was pointed out that the scheme could not be put into practice without the granting of statutory authority. This requirement will be met by the Municipal Savings Banks (War Loan Investment) Bill, which has been presented by Mr. Montagu, and is now before the House. The object of this measure is "to facilitate the investment of savings in securities issued for the purposes of the present war by means of the establishment of municipal savings banks;" and the provisions are set forth in a single section. It will make it lawful for the councils of municipal boroughs and urban districts in England, and royal parliamentary and police burghs in Scotland, having a population, according to the census of 1911, of not less than 50,000, the councils of metropolitan boroughs, and the Common Council of the City of London (with the consent of the Treasury after consultation with the Local Government Board), to establish and maintain savings banks—receiving deposits, and guaranteeing the

payment of interest and the repayment of the deposits. For this purpose, the authorities will be empowered to charge such rate or fund out of which any of the expenses of the council are payable as may be prescribed by regulations made under the section. One of the conditions to which the permission is subject is that the bank shall not be carried on (otherwise than for the purpose of winding it up) after the last date fixed for the repayment of any of the securities in which the funds of the bank are authorized to be invested. Again, all sums belonging to the bank, except such as are retained to meet current liabilities, shall be invested in securities issued by the Treasury for the purpose of this war, and repayable within five years from the date of issue. The accounts of the bank must be kept separate, and be properly audited; and money paid in must, of course, not be used for any purpose of the council other than the bank. The rate of interest payable on deposits will be subject to approval by the Treasury; and the general regulations for carrying on the bank will be such as the Treasury (after consultation with the Local Government Board) may prescribe. These regulations may apply any of the provisions contained in the enactments relating to savings banks; but, save as so applied, these enactments shall not apply to a savings bank established under the Act. From this it will be seen that there is nothing complicated about the Government scheme, which is a simple attempt to offer facilities to the working classes for doing that which they should do.

Daylight Saving and National Economy.

In our "Parliamentary Intelligence" on the 14th ult., it was mentioned that the Prime Minister had, in reply to a question, stated in the House of Commons that he did not think there was sufficient reason to appoint a Committee of Inquiry into the subject of daylight saving in relation to national economy. Since then, information from Berlin (*viâ* Amsterdam) states that the Federal Council have adopted a daylight saving measure to be enforced during the summer months. Austria, it is announced, is following suit. From Paris comes the intelligence that a Parliamentary Committee have recommended that, for the duration of the war, legal time shall be advanced one hour; and Italy it is said is allied in this movement as well as in the war. The daylight saving scheme had its birth in this country; but, though the idea has gained adherents here, it has not for various reasons obtained sufficient support to carry it to the stage of acceptance. It is thought by those who favour it that this shows a defect in our national character—an objection on the part of large sections of public opinion to make any change at all. However, history repeats itself; other countries are leading in the adoption of a British-born idea, and are doing so in the cause of national economy. In this instance, they are welcome to make all possible use of the notion. Although few people would desire to stand in the way of the utilization of any scheme that would really, all things considered, promote national economy, those engaged in the lighting industries will secretly be thankful that such a large mass of public opinion in this country is opposed to making a change in the hours of activity, and especially now when lighting restrictions and shorter hours of retail business and the lessened opening hours of licensed premises have been playing such havoc with gas and electricity consumption.

Explosives in Modern Warfare.—There is an article in the April number of the "Windsor" magazine, by the late Professor Vivian B. Lewes (said to be one of the last things he wrote), on the "Explosives Used in Modern Warfare." In this it is pointed out that the modern high explosives which are playing so important a part in the shells used for destroying the wire entanglements and trenches before any advance can be made, are compounds produced by acting on coal-tar products with nitric acid. The black tar yielded by the carbonization of coal in the gas-works and coke-ovens can, by fractional distillation, be made to yield benzene, toluene, and carbolic acid, all of which can be nitrated to give high explosives capable of being detonated. The carbolic acid yields, on nitration, picric acid, the basis of the English lyddite, the French melinite, and the Japanese shimose powder; while an explosive attracting even greater attention in the present war is obtained in the same way by nitration from toluene. Probably the most powerful explosive known is made from benzene by converting it into aniline and, by nitration, making this into tetranitro-aniline, an explosive of which a great deal more will be heard; while another derivative, tetranitromethylaniline, known as "tetryl," is being used largely in detonators. The great value of the high explosives is the terrible concussion transmitted through the air by their detonation, which often kills the defenders in the trenches without their being struck.

PERSONAL.

The Wells-next-the-Sea Urban District Council have appointed as their Gas Manager Mr. A. T. HOWARD, of Hingham.

Mr. JAMES KIRK, of the Cowdenbeath Gas-Works, has been appointed Manager to the Auchterarder Gas Company, in place of Mr. W. MANN, who has gone to Stevenston, Ayrshire.

On the occasion of his leaving Tyldesley to take up his new appointment as Engineer with the Cannock, Hednesford, and District Gas Company, Mr. W. J. Matthews, on behalf of the Tyldesley District Council staff, presented to Mr. HEDLEY HOY a silver cigarette case suitably inscribed. In making the presentation, Mr. Matthews spoke of the able and faithful service which Mr. Hoy had rendered during the three years he had had charge of the Tyldesley gas and water undertakings. Mr. Hoy, in responding, said he was sorry to leave his old colleagues, and should always look back on the time he had spent with them as a very happy one.

The retirement after over twenty years' service of Mr. J. J. LACKLAND, the Water Engineer, was announced at a meeting of the St. Helen's Water Committee a few days ago. Alderman Nuttall (the Chairman) said the Committee were exceedingly sorry to lose Mr. Lackland; but he was seventy years of age, and felt that he needed a rest. They all hoped he would have good health, and live long to enjoy his leisure. Mr. Lackland is a native of South Shields. After his training as an engineer, he was associated with several railway and water-works undertakings at Newcastle and North Shields. Nearly forty years ago he became Assistant Water Engineer to the Staffordshire Potteries Water-Works Company at Hanley, and at the end of seventeen years removed to St. Helens.

On the occasion of the marriage of Mr. JOHN W. M'LUSKY, the Engineer and Manager of the Corporation Gas-Works, Airdrie, which takes place at Portrush to-morrow, presentations were made by the staff, employees, and friends at the Airdrie Gas-Works. Mr. Stewart, the Works Superintendent, presided, and called upon Mr. R. D. Hunter, the cashier, to make the presentation. In doing so, he said Mr. M'Lusky had been with them for some time now, and had won the respect and esteem of them all. He had very great pleasure in asking his acceptance of the gifts now before them—a Chippendale timepiece and a music cabinet—from the staff, employees, and friends of the Gas Department; and he expressed the feeling of every one of them when he said that the gifts were accompanied by their heartiest good wishes for his future prosperity and happiness. For the future Mrs. M'Lusky he also asked the Manager to accept a piece of jewellery as a small token of their hearty good wishes for her, and as an indication of the spontaneous welcome she will receive on coming to Airdrie. Mr. Hunter also asked Mr. M'Lusky's mother, who was present, to accept from them a handsome umbrella as a recognition of appreciation of her kindness to all in the Gas Department. Mr. M'Lusky suitably returned thanks for the gifts.

OBITUARY.

The death occurred last Tuesday of Alderman JOHN HORTON BLADES, for many years Deputy-Chairman of the West Bromwich Gas Committee. Deceased, who was 75 years of age, was one of the leading public men of the borough.

The death took place last Saturday morning of Mr. S. W. KENNETT. The deceased gentleman was Manager of the Shipping Department of Messrs Stephenson Clarke and Co., and had been with the firm thirty-seven years. He was a member of the Evening Star Lodge, and P.M. of the Carbon Lodge. The funeral will take place at Abney Park Cemetery, Stoke Newington to-morrow (Wednesday) at 3 o'clock, preceded by a service at St. Andrew's Church, Bethune Road, at 2.30.

Mr. F. M. HARRIS, the Chairman of the Ross (Herefordshire) Gas Company, Limited, who died in that town last week, at the age of 65, was better known to the industry as Engineer and Manager of the Barry Gas-Works—a position he occupied for just about twenty years. He left Falmouth in 1887 to go to Barry, and remained there as Engineer to the gas-works until the gas and water departments were amalgamated in 1907, when Mr. Harris left, and Mr. F. E. Franklin was appointed Engineer. Deceased is survived by a son and a daughter.

The death has occurred, at his residence at Dudley, of Mr. GEORGE A. COLLINS, who for 57 years was engaged by the Dudley Gas Company as Engineer, and in recent years acted as Manager. He was 71 years of age, and during his long tenure of office had seen the Dudley Gas-Works, started in a very humble way, rise to the important place they now occupy in the town's industries. By Directors, staff, and workmen Mr. Collins was very highly esteemed; and by the former his services were at all times thoroughly appreciated. The staff recognized him as a conscientious colleague; while the workmen who knew him longest and best always spoke highly of him. He had spent his lifetime in watching the developments of the works, and was eminently successful in everything he tried to achieve. He had been in failing health for the last twelve months; and his duties have devolved upon his eldest son, Mr. W. Collins.

RETURNS RELATING TO GAS.

Official Figures to December, 1913, and March, 1914.

AFTER a lapse of two years, there have been published another set of returns relating to the gas undertakings of the United Kingdom, which bring the figures on one year beyond those that were dealt with in the "JOURNAL" for March 24, 1914. That is to say, the returns now issued are for the year ended Dec. 31, 1913, in the case of companies, and for the twelve months to March 31, 1914, for the local authorities.

The undertakings with regard to which particulars are to be found in the returns number 831, which is five more than was the case the year before. The new comers among the local authorities are the councils of Bala, Holme Cultram, Mynyddislwyn, Sidmouth, Southend, Doune, Lanark, and Mallow. Fresh names among the companies include Kibworth, Llantrisant and District, Porthcawl and District, and United District. Several companies have dropped out of the list through amalgamation, purchase, &c. Of the total of 831 undertakings, 519 are in the hands of companies, and 312 belong to local authorities.

The total amount of capital authorized is stated at £162,346,673, of which £139,727,277 has been paid up and borrowed. For the local authorities, the capital authorized is £48,612,203, and the amount borrowed £44,554,222. In the case of the companies, the amount authorized is £113,734,470; being £90,424,862 share capital, and £23,309,608 loan capital. The amount paid up and borrowed is £95,173,055. The receipts are: Companies, £23,296,963; local authorities, £12,206,595—total £35,503,558. The expenditure is: Companies, £18,580,794; local authorities, £9,661,310—total £28,242,104. In the companies' return, three columns which appeared last year have been omitted this time. They are: Amount of authorized capital subject to the auction clauses. Amount of capital sold by auction or tender under auction clauses. Amount of premium realized by sales of shares under auction clauses, and applied to capital account.

It is to be gathered from the statistics relating to working that 16,971,724 tons of coal were carbonized; the quantity of gas produced being 224,517,167,000 cubic feet, of which 206,474,473,000 cubic feet were sold. The total make includes 23,778,609,000 of water gas, and 4,911,989,000 cubic feet of "other gas." Of the "other gas," 4,846,950,000 cubic feet was made by the South Staffordshire Mond Gas Company. The totals in the preceding returns were: Coal, 16,052,487 tons; gas made, 215,492,714,000 cubic feet; gas sold, 198,922,469,000 cubic feet; water gas made, 27,141,026,000 cubic feet; acetylene gas made, 103,000 cubic feet. At the date on which the latest returns were made up, there were 39,099 miles of mains in use for the supply of 7,103,113 consumers and 741,703 public lamps. The figures for the previous twelve months were: Mains, 37,744 miles; gas consumers, 6,876,149; public lamps, 735,121.

The present returns differ from the preceding ones in the manner in which the number of consumers, the prices charged, and the quantity of gas consumed are set out. Instead of, as before, the last two items being separated out merely into private consumers and public lamps, the prepayment consumers are in each case dealt with apart; and, in addition, there are shown special prices for power, &c., and the quantity of gas sold in bulk. In the case of the companies, the 130,175,199,000 cubic feet sold (which excludes 480,848,000 cubic feet sold in bulk) is divided up as follows: Ordinary consumers, 90,141,743,000 cubic feet; prepayment consumers, 34,312,075,000 cubic feet; and public lamps, 5,721,381,000 cubic feet. Of the 4,214,865 company consumers, there were 2,473,592 prepayment and 1,741,273 ordinary. Taking the local authorities, the 76,299,274,000 cubic feet of gas consumed (which excludes 148,428,000 cubic feet sold in bulk) is split up in this way. Ordinary consumers, 55,585,905,000 cubic feet; prepayment consumers 15,632,769,000 cubic feet; and public lamps, 5,080,600,000 cubic feet. Of the 2,888,248 consumers, 1,296,737 were prepayment and 1,591,511 ordinary consumers.

With reference to the water-gas tables, it may be remarked that in the companies list the new names are Barnet, Farnham, Leamington, Redditch, and Salisbury; while Faversham and Pontypool fall out. Among the local authorities, Denton and Kingston-upon-Hull are additions; and Middlesbrough, Stafford, and Todmorden come out. It will be seen that on this occasion the average, as well as the maximum, proportion is given for the admixture of water gas with coal gas.

Acetylene gas was again used by the Portsoy Corporation; the quantity made in the year ended May 15, 1914, being 109,000 cubic feet.

Ten Years' Figures Summarized.

Companies.

Year.	Share and Premium Capital Paid Up.	Loan Capital Issued.	Receipts.	Expenditure.
1904. . .	£68,953,306	£13,775,734	£17,828,872	£13,397,727
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369
1907. . .	73,152,891	14,645,271	19,567,336	14,884,982
1908. . .	74,328,645	14,944,060	20,013,159	15,475,933
1909. . .	74,952,664	15,168,298	19,951,779	15,097,658
1910. . .	76,797,028	15,396,163	20,446,438	15,308,928
1911. . .	77,382,751	15,606,929	21,134,770	15,903,361
1912. . .	77,963,589	15,816,405	22,358,030	17,231,015
1913. . .	78,903,298	16,269,757	23,296,963	18,580,794

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Supplied.
1904. . .	8,673,343	105,311,980,000	2,588,917	343,908
1905. . .	8,722,145	109,823,682,000	2,813,156	350,113
1906. . .	8,922,781	114,528,923,000	3,023,619	356,070
1907. . .	9,240,280	118,699,705,000	3,230,993	362,986
1908. . .	9,281,738	119,985,109,000	3,399,193	367,950
1909. . .	9,175,532	122,930,431,000	3,573,796	369,882
1910. . .	9,236,081	125,830,234,000	3,751,703	371,665
1911. . .	9,431,841	130,562,246,000	3,906,528	373,203
1912. . .	9,563,219	137,007,569,000	4,062,289	373,793
1913. . .	10,118,399	142,251,637,000*	4,214,865	375,056

* Including 18,392,121,000 cubic feet of water gas and 4,907,696,000 cubic feet of "other gas." Number of cubic feet sold, 130,175,199,000.

Local Authorities.

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1904-05 .	£38,512,295	£9,546,682	£7,052,474	£1,738,682	£790,450
1905-06 .	39,401,896	9,636,107	7,085,710	1,799,094	798,210
1906-07 .	40,089,167	9,843,243	7,211,987	1,843,122	832,341
1907-08 .	40,712,159	10,500,416	7,839,122	1,882,427	827,454
1908-09 .	41,435,988	10,506,480	7,998,776	1,905,810	659,445
1909-10 .	42,002,322	10,398,263	7,710,985	1,970,241	767,961
1910-11 .	42,490,504	10,829,758	7,902,451	1,963,015	973,934
1911-12 .	43,108,248	11,184,000	8,161,944	1,990,756	1,045,057
1912-13 .	43,681,976	11,910,340	8,799,164	1,980,247	1,157,674
1913-14 .	44,554,222	12,206,595	9,661,310	1,995,441	719,561

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Supplied.
1904-05. .	5,622,259	63,335,696,000	2,148,260	310,275
1905-06. .	5,758,180	65,081,109,000	2,250,919	315,678
1906-07. .	5,923,476	67,312,153,000	2,339,914	321,910
1907-08. .	6,166,473	69,786,988,000	2,434,185	327,278
1908-09. .	6,112,569	69,933,629,000	2,516,927	332,746
1909-10. .	6,049,788	70,616,963,000	2,590,270	343,021
1910-11. .	6,161,702	72,903,220,000	2,666,146	349,120
1911-12. .	6,203,171	75,053,780,000	2,743,376	355,345
1912-13. .	6,489,268	78,485,145,000	2,813,860	361,328
1913-14. .	6,853,325	82,265,530,000*	2,888,248	366,647

* Including 5,386,488,000 cubic feet of water gas and 4,293,000 cubic feet of "other gas." Number of cubic feet consumed, 76,299,274,000.

Undertakings Making Water Gas.

[With maximum and average proportions of admixture with coal gas.]

Local Authorities.

Aberdeen‡ (max., not stated; av., 29).
Accrington (max., 25; av., 20).
Ashford (max., 31; av., 23·2).
Barrow-in-Furness (max., 33; av., 27).
Barry (max., 25; av., not stated).
Belfast (max., not stated; av., 41·539).
Birkenhead (max., 37·1; av., 27·53).
Birmingham (max., 25; av., 18).
Blackburn† (max. and av., 25).
Burnley (max., 40; av., 25).
Carlisle (max., 26; av., 8·78).
Chorley (max., 16; av., 13).
Coventry (max., 24·39, one day only; av., 2·28).
Denton (max., 33·3; av., 25).
Devizes (max., 31; av., 10·55).
Devonport (max., 44·8; av., 26·39).
Dundee§ (max., 9; av., 0·51).
Edinburgh‖ (max., 13·31; av., 0·86).
Halifax (max., 10; av., 5).
Hebden Bridge (max., 35; av., 15).
Kingston-upon-Hull (max., 29; av., 27·8).
Leeds (max., 49, on Dec. 17, during municipal strike; av., 6).
Leicester* (max., 20·69; av., 2·04)
Leigh (max., 10; av., 5).
Lincoln (max., 33⅓ in daytime, none at night; av., not stated).
Longton (max., 30; av., 5·7).
Loughborough (max., 25; av., 20).
Manchester (max., not stated; av., 16·54).
Mansfield (max., 10; av., 3·7).
Nelson (max., 10; av., 0·5).
New Mills (max., 30; av., 20).
Nottingham (max., 11.22; av., 1·9).
Oldbury (max., 30·6; av., 10·6).
Oldham† (max., 11·10.; av., 3·37).
Pontypridd (max., 21·15; av., 8·66).
Rochdale (max., 15; av., 10).
Smethwick (max., 30; av., 10).
Southport (max., 30·34; av., 2·94).
Stockport (max., 25; av., 19·37).
Stockton-on-Tees (max., 28·1; av., 8·2).
Stourbridge (max., 25; av., 15).
Tipton (max., 12; av., 2).
Torquay* (max., 34·4; av., 30·2).
Tyldesley (max. and av., 20).
Walsall* (max., 20; av., 6).
West Bromwich (max., 16·6; av., 2·58).
Wigan (max., 30; av., 19).

* The return is for the year ended Dec. 31, 1913. † The return is for the year ended March 25, 1914. ‡ The return is for the year ended July 31, 1913. § The return is for the year ended April 30, 1914. ‖ The return is for the year ended May 15, 1914.

Companies.

Aldershot (max. not stated; av., 17·6).
Alliance and Dublin (max. not stated; av., 27·9).
Aylesbury (max., 14; av., 10).
Barnet (max., 38·6; av., 6·5).
Bath (max., 50; av., 19).
Bexhill (max., 71·78; av., 45·34).
Bilston§ (max., 10; av. not stated).
Bishop's Stortford (max., 35·22; av., 13 27).
Bognor (max., 30; av., 10).
Bournemouth (max., 42; av., 40).
Brentford (max., 45; av., 37).
Bridgwater* (max., not stated; av., 15).
Bridlington (max., 36; av., 20).
Brighton (max., 40·47; av., 29).
Bristol (max., 28·71; av., 12·27).
Cardiff (max., 33; av., 29·82).
Chelmsford (max., 23; av., 16).
Cleethorpes (max., 15·93; av., 6·9).
Colchester (max., 34; av., 24·35).
Commercial (max., 41·46; av., 31·86).
Croydon (max., 48·7; av., 19).
Dartford (max., 14·1; av., 4·1).
Dorking (max., 55; av., 2·94).
Durham (max., 20; av., not stated).
Eastbourne (max., not stated; av., 23).
Falmouth* (max., 20; av., 12).
Farnham (max., 27·9; av., 9·46).
Felixstowe (max., 22·89; av., 9·17).
Folkestone (max., 33; av., 31).
Gas Light and Coke (max., 23·4; av., 18).
Gosport (max., 20; av., 6·2).
Gravesend‡ (max., 47; av., 32·6).
Grays and Tilbury (max., 30; av., 27·65).
Guildford (max., 15; av., 12·5).
Hampton Court (max., 32·3; av., 16·6).
Harrow (max., 43; av., 31).
Hartlepool†† (max., 23; av., 15).
Hastings (max., 38·76; av., 28·37).
Hornsey (max., 43; av., 21).
Horsham (max., 25; av., 23·8).
Hull—British (max., 29; av., 27·85).
Hythe and Sandgate (max., 25; av., 15).
Ilford (max., 26·43; av., 18·53).
Ilfracombe (max. 12; av., 4·36).
Ipswich (max., 23·18; av., 18·20).
King's Lynn (max., 26·69; av., 6·6).
Kingston-on-Thames (max., 35; av., 25).
Liverpool (max., 50; av., 32·58).
Lea Bridge (max., not stated; av., 50·7).
Leamington Priors (max., 10; av., 6).
Londonderry (max., 15; av., 3).
Maidenhead (max., 35; av., 28·3).
Maidstone* (max., 15; av., 11).
Malton (max., not stated; av., 33).
Marlborough (max., 50; av., 15·3).
Merthyr Tydfil (max., 30; av., 20).
Mid Kent (max., not stated; av., 26).
Newcastle-upon-Tyne (max., 9·73; av., 3·83 for one week).
Newport, Mon. (max., 19; av., 12·6).
North Middlesex (max., 70·81, for one day only; av., 40·59).
Norwich—British (max., 30·9; av., 20·9).
Nuneaton‖ (max., not stated; av., 0·00422).
Plymouth† (max., not stated; av., 32·52).
Portsea Island (max., 47·8; av., 29·6).
Prescot (max., 25; av., 12·4).
Preston (max., 34·9; av., 20·4).
Ramsbottom (max., 30; av., 3).
Reading (max., 32·9; av., 16·8).
Redditch (max., 24·48; av., 14·48).
Redhill (max., 34, one day only; av., 2·9).
Rhymney (max., 20; av., 12).
Ripley (max., 20; av., 10)
Rochester (max., 45; av., 40).
Romford (max., 28; av., 23·2).
Rushden and Higham Ferrers (max., 51·02; av., 22·03).
St. Albans (max., 30; av., 25).
Scarborough (max., 53; av., 30).
Southampton (max., not stated; av., 34).
Southend (max., 35·93; av., 22·47).
Southgate (max., 51·4; av., 37·04).
South Shields (max., 25·67; av., 6·08).
Salisbury* (max., 30; av., 19·5).
Staines and Egham§ (max., 36·87; av., 24·74).
Stretford (max., 29·37; av., 13·9).
Swansea (max., 35; av., 25).
Swindon United (max., 48; av., 37·7).
Taunton (max., 35; av., not stated).
Tonbridge (max., 25; av., 13·8).
Torquay (max., 40; av., 25).
Tottenham (max., 46, for one day only; av., 29·5).
Truro* (max., 50; av., 30).
Tunbridge Wells (max., 30; av., 25
Uxbridge (max., not stated; av., 16).
Waltham Abbey (max., 33; av. 20).
Wandsworth (max., 31; av., 8).
Watford (max., 33; av., 30).
Weston-super-Mare (max., 50; av., 45·45).
Wexford* (max., about 40; av., about 33).
Winchester (max., 31; av., 24).
Wolverhampton (max., 23·3; av., 14·8).
York (max., 31·54; av., 12·82).

* The return is for year ended June 30, 1914. † The return is for the year ended March 31, 1914. †† The return is for the year ended June 30, 1913. ‡ The return is for the year ended June 24, 1913. § The return is for the year ended Sept. 30, 1913. ‖ The return is for the year ended March 25, 1914.

Filtration of Water.

A paper was read at last week's meeting of the Institution of Mechanical Engineers, by Mr. Walter Clemence, on "Theory and Practice in the Filtration of Water," in which, after a brief reference to sand and mechanical filters, the author dealt with the subject of multiple filtration, the first large installation for which, for a potable water supply, he said, was constructed by the authorities of the City of Paris at Ivry in 1900, at a time when sand-filters were first used in France on a large scale. As the system has progressed, three notable features have been introduced. It is now the practice to introduce a pre-filter of coarse sand between the degrossisseurs and final filters. This has the effect of almost completely eliminating suspended matters, and greatly prolongs the life of the final filters. (2) For potable waters, cascades are introduced between the successive stages of straining, so that the supply of dissolved oxygen is fully maintained. (3) The degrossisseurs are fitted with an apparatus for rapidly removing the silt collected by the straining materials, by means of air and flushing with unfiltered water. The pre-filters are also frequently fitted with apparatus for cleaning the surface of the sand while the basins are submerged. Mr. Clemence described four examples of multiple-filtration installations which have been designed to deal with waters differing widely in character. At Magdeburg, the River Elbe is usually turbid and polluted with refuse from factories; the Derwent Valley scheme treats an upland water charged with peaty acids; at Accra (Gold Coast Colony), the River Densu is polluted with decaying vegetation from swamps; while at Cawnpore the River Ganges is organically pure, but usually turbid with clay and silt particles. In each case the slow sand-filter is relied on for final purifiation; the remainder of the plant being designed to bring the water to such a condition before reaching the final filters that the best possible results may be obtained from them.

ELECTRICITY SUPPLY MEMORANDA.

VERY little is heard just now about the rateable value system, with its fixed lump-charge, and ½d. a unit in addition. Such fancy systems of charging do not fit the times of high prices for coal, oil (fuel and lubricating), materials generally, and labour, and increased tax outgoings. The idea that the fixed percentage would equal what was formerly the income from lighting has been "mined" by experience. There can be no uniform percentage on rateable value which will be equivalent in all cases (in view of the varied individual circumstances) to the prior payment for lighting. Experience, too, before the war, and when prices of coal, &c., were normal, showed that, under the rateable value system, consumption in many instances rose enormously, while the total amount of the account was lower than obtained with the previous smaller consumption. Such consumers gleefully rubbed their hands over the fatuity of such benevolence; and those who advised the adoption of the tariffs, and saw what was happening in a number of cases, pulled wry faces, although disinclined to publicly acknowledge their error. With such a condition of things in pre-war times, the position is worse now that expenditure has assumed such frightful additional substance. If it is necessary to add 10, 15, or 20 per cent. to the flat-rates that were in existence, then surely those consumers who are, under the rateable value system, paying less on the average than the flat-rates, under equal conditions of consumption, ought to have a larger percentage added to their accounts. We deliberately use the words "under equal conditions of consumption," because otherwise there might be an attempted evasion of the point by saying that the greater consumption is due to use during daylight hours. But the making of such a point may be crippled straight away by the admission already referred to as to, in many cases under the rateable value system, greater consumption and lower income, and by the fact that the coal that is costing 50 and more per cent. [Marylebone confesses to the expenditure on coal being 67 per cent. more now than at the beginning of 1915], the materials and goods that are at much higher prices, the labour that is receiving higher remuneration, and the taxes that have risen considerably, each and all apply probably as much to the day as to the night consumption. Consumers on the rateable value system who since the war began have been using a large quantity of current, at a total cost less than they were paying previously on a flat-rate, are not doing their share to-day by paying only the same percentage addition as the flat-rate consumers.

Rateable Value System in War Time.

Flat Rates in War Times.

Under current circumstances, there are central station electrical engineers who agree that it is altogether impossible to make anything like safe forecasts of income and expenditure, so as to show, with fair assurance, what is likely to be the final issue of the financial year. This difficulty must be intensified by having a wonderfully mixed tariff embracing high and low flat-rates, the rateable value system (with its undesirable effects upon consumption and income) and secret contracts at infinitesimal prices per unit for power, &c. Under the circumstances, the flat-rate system is holding its own in favour. There are electrical undertakings which, with a smaller volume of business and flat-rates, showed much better financial results in years past than they have done since they began dabbling in extraordinarily low prices for this and that, and adopted various tariffs that have no firmness or equality about them in relation to the actual business. Costs for coal, material, labour, and taxes threaten to continue high long beyond the period of the war; and additions to tariffs that are compulsory now will be found, in part at any rate, to be necessarily something more than a temporary expedient. Those undertakings, therefore, which are taking advantage of the present opportunity to put their tariffs on a sound foundation, and to consolidate them, will find the wisdom of having done so for some time ahead, when the consumers in other cases are clamouring, immediately after the war, for the removal of the 10, 15, or 20 per cent. additions which have been made, and which, being special in character, suggest something of only ephemeral character. In some directions flat-rates are superseding mixed tariffs; in others the flat-rates are being revised, so as to more fairly distribute increased costs. It is much easier to add to flat-rates, and afterwards reduce gradually as opportunity allows, than to, after making a percentage addition to the accounts, maintain the percentage when the conditions have returned to what the consumers regard as normal. But in connection with flat-rate revisions, the charges for power, heating, and cooking are being raised—variously from 1d. to 1½d., 2d., and even to 2½d. per unit, and sliding-scales of price according to consumption are freely coming into operation. This is very much against the ideas of those who have advocated the policy of power, heating, and cooking business at thin prices. These advocates are frequently men who are not responsible for the financial stability of an electrical undertaking; and some furious kicks have been administered by them against the trend of affairs. But they should recognize that if, when coal was 50 to 75 per cent. cheaper than now, when other materials, labour costs, and outgoings generally were much lower than now, 1d. per unit was (of course, we know it was not) a good competitive price for power, heating, and cooking, then

to-day 1½d. to 2d. per unit are quite proper relative charges, and should easily sweep in the business. These are the men who would prefer to see the additional costs incurred to-day in supplying energy for power, heating, and cooking foisted on the lighting consumer, or, in the case of municipal concerns, be left to be defrayed out of the general rates. Such courses are not equitable; and electric lighting consumers are beginning to rebel. They are waking-up to the facts of their position; and there will be a growing objection on their part to continuing to be the victims of artifice and illusion.

Non-Paying Power Supply.

Reference was made last week to the times when, to develop power business, prices for the energy were put very low—in some cases at figures under the average cost of fuel per unit. The excuse for this was that it was an imperative necessity to develop a day-load, in order to make the best use of the plant requisite for the lighting business. Now that in many instances more plant is needed for the power business than for the output for lighting, the argument has lost its footing. But lighting charges are still comparatively high, and form the backbone of the revenue. In such cases another reason must now be advanced for the continuation of the attenuated prices for power; and the only other one that can be found is that the costs of power by other means simply defy and obstruct the raising of prices for electrical energy. But is this fair? We have before us an actual case which illustrates the injustice of the position. Prior to the war a large engineering works was being supplied at a low price with energy by a central station under municipal control. Since the war the establishment has been converted into a munitions factory; and more electrical energy was needed. The plant at the central station was equal to the pre-war demands for lighting and power; but the additional requirement for energy for the factory necessitated the installation of a new generating set, and the laying of a long length of cable. Now what possible justification is there for supplying the power demands of this factory at a price which does not cover all generating (enhanced under war conditions), distribution, and proportion of capital and other charges on the old plant required, and the whole of the capital charges involved in making the additional provision? The central station in question is to-day showing what, to the best of our recollection, is a record deficit. The ratepayers are up in arms over the situation, coming as it does at a period when the pressure on them is heavy in all directions; and the electrical engineer's ears and eyes can rarely be at peace (what with ratepayers' complaints and mural notification of resentment) except when in the seclusion of his home.

Electric Cooking in Business Establishments.

We remember some time ago referring to the fact that Selfridge's had installed electrical apparatus in one of their kitchens; we also recollect that it was then stated that the older kitchen was still equipped with the appliances that had done duty before the electrical experiment was instituted. The "Electrical Times" has lately devoted nearly two pages to an illustrated description of the installation; but it carefully refrains from saying anything about the older kitchen, which is a slight, if the kitchen is still in existence. It may be taken that it is, seeing that it is stated that there are no fewer than 4000 employees attached to the Oxford Street Stores, and that during February 15,696 luncheons were served and 12,952 teas, which would only average rather less than four luncheons per month per employee, and rather more than three teas. No hard-working employee at Selfridge's or any other big emporium could subsist on one luncheon per week, and less than one tea. However, that by the way. There are many thousands of large business establishments in existence; and the "Electrical Times" prides itself on being able to announce that installations of electric cooking appliances for the staffs have been made at six of them. They are to be found at Messrs. Debenham and Freebody, Messrs. Harvey Nichols (of Knightsbridge), Messrs. Buntings (of Norwich), the Stratford Co-operative Society, and Messrs. Swan and Edgar. These make a very small hole in the staff kitchens of large business establishments; and it is now some time ago, when Mr. Debenham was Chairman of the Marylebone Electricity Committee, that his firm adopted electricity for cooking—under the watchful eye of Mr. A. H. Seabrook, and possibly on tempting terms.

Equipment, B.Th.U., and Ventilation.

To return to Selfridge's, the electrical equipment consists of two Jackson roasting ovens, a fish-fryer, a grill with hot closet, a stockpot, and a hot cupboard. There is also a range of four boiling-discs, and five copper urns of 10 gallons each. It is very generally recognized by electricians that, by large-scale cooking, the lowest records in the matter of electricity consumption can be realized. Mention has already been made of the number of luncheons and teas served during February; and during the month 4196 units of electricity were used for cooking and boiling. This, it is stated, works out to 0·146 unit per meal. The part that electricity plays in the making of a cup of tea is in this case called cooking a meal! It is an extremely fine, not to say artful, way of presenting a low average per "meal." Of what the "meals" consisted is not divulged. The charge for the current is only ½d. per unit, which cannot pay at the present price of coal delivered at Marylebone; and the daily cost for current is 8s. 4d. This means 200 units per working day; and 200 units are equal to 684,000 B.Th.U. At 2s. 6d. per 1000 cubic feet, the Gas Light and Coke Company supply to the ordinary consumer for 8s. 4d. 3333 cubic feet of upwards of 500 B.Th.U. per cubic foot. At the round figure, the B.Th.U. generated by the 3333 cubic feet of gas would be 1,666,500, or 982,500 more than the thermal value obtainable from the 200 units of electricity sold at ½d. per unit! Yet the 8s. 4d. is stated by the "Electrical Times" to be "substantially lower than would be possible with gas or coal heated apparatus." Marvellous, is it not? And postulation is never over-careful as to its strength. In the early part of the article, too, it is stated that the basement in which the electrical apparatus is situated is low-pitched; and that neither gas nor coal could be used in the space available. In this part of the article there is also mention of the absence of dirt and smell, of extraneous heat, and of *flues*. Towards the end of the article, there is the contradiction—if "mains" mean "flues." There it is stated that ventilation is "provided for by exhaust fans and sheet metal *mains*, with openings at convenient points." In time, a large rebuilding scheme is to be carried out in connection with the extension of Selfridge's establishment; and the hope is expressed by our contemporary that it may then be in the position to announce that the new and enlarged kitchen that will be needed will be equipped electrically throughout. This looks as though no determination has yet been arrived at.

Coke and Oil for Electricity Generation.

"Electrical Engineering" gives a digest of an article published in the "Zeitschrift für Dampfkessel und Maschinenbetrieb," regarding the effect of the war on the materials required for electricity generation in Germany. The difficulties created by the shortage of men, the disorganization of normal transport conditions owing to pressing military requirements, and a certain unfeeling blockade are spoken of. In the midst of much else we read: Some relief was obtained by the mixing of coke (of which there were ample stores) with boiler coal. The effect of this on the efficiency was bad; but from various other standpoints—such as reduced smoke emission and less deposit of soot on the heating surfaces—the results obtained are said to have been advantageous. With mechanical stokers, the admixture of coke worked quite well so long as it was broken beforehand. At present a further use of coke for power plants is not encouraged, as this extra demand has had the effect of creating a shortage of coke for the central heating and other furnaces. While steam operation has proved its reliability and value during the war period, Diesel and other oil-engine plants have fallen completely from their high economic level, owing to the excessive price and scarcity of oil; and they cannot now compete with even old steam plants. The price of crude oil had already begun to rise alarmingly before the war. In February, it was difficult to obtain any at even four times pre-war prices; and some classes of oil are absolutely unobtainable. Regarding the use of coke, central stations in this country, with forced draught arrangements to their boilers, find coke a suitable and economical fuel.

INTERIOR ILLUMINATION AND GLARE.

The Committee on "Glare" of the American Illuminating Engineering Society recently issued a report (which is embodied in their last "Transactions") showing the practical application of some of the principles set forth in their general report on glare. Tentative figures are given, indicating the safe limits of practice for contrast of brightness within the range of vision in interior illumination so as to avoid the bad effects of glare. It is suggested that brightness calculations to show the probable brightness contrasts introduced might well supplement the useful illumination calculations now commonly made.

For the convenience of the reader, the definitions of glare tentatively advanced by the Committee in their general report are reproduced as follows: (1) Brightness within the field of view of such excessive character as to cause discomfort, annoyance, or interference with vision. (2) Excess brightness of, or flux of light from, the whole or a portion of the field of view, resulting in reduced vision, fatigue, or discomfort of the eye. (3) Light shining into the eye in such a way, and of sufficient quantity, as to cause discomfort, annoyance, or interference with vision.

It is obvious, they point out, that the illumination of interiors should be arranged to avoid glare as defined; the brightness within the field of view must be so distributed as to avoid this effect. It is also evident that brightness within the field of view includes not only sources of light and their equipment of globes or reflectors, but also ceilings, walls, papers, and desks. The engineer should take into account everything that is within the field of view.

The foregoing definitions of glare include three effects. It should be noticed that brightness conditions producing any one or two of the effects may be present alone, or all three may be in evidence. For example, interference with vision, also commonly known as "blinding effect," from a bright lamp may not be measurable when the lamp is at an angle of more than 25° to 30° from the centre line of vision. But it has been well demonstrated that excessive brightness anywhere within the visual field

(even although it be outside the blinding effect zone) may be decidedly annoying and fatiguing. As far as interference with vision is concerned, the engineer is not nearly as limited in the choice and placing of equipment as he is by the other considerations of fatigue and annoyance.

In the practical lighting of interiors to avoid glare effects, it is essential to determine what contrast ratios in brightness of adjacent surface the eye can tolerate continuously without suffering any of the fatiguing or annoying effects of glare. While the experimental data are not perhaps as complete as might be wished, enough has been collected to set the tentative limit of good practice.

In sunlight out-of-doors, brightness ratios of adjacent surfaces —excluding, of course, the sun, which is avoided by the eye—are usually not over 1 to 20, and generally much less. The largest contrast ratios are found on bright days in the contrast between surfaces in full sunlight and those in deep shadow. We know that the eye is adapted to ordinary outdoor conditions without suffering the effects of glare.

For indoor conditions, the data which we have on the effects of glare consist of measurements of brightness taken both in rooms where conditions are known to have been such as to produce glare-effects from the complaints of the occupants, and in other rooms where no such complaints have been made. We have also brightness measurements in rooms used in a limited number of tests made for eye fatigue by the Ferree method, under conditions which produced various amounts of eye fatigue.

A study of these data shows that usually where glare effects have not been observed, the contrast ratios between the brightest surfaces within the range of vision and the surfaces immediately adjacent are not over 1 to 100. Of course, the contrast ratio taken in this case is that presented to the eye—in other words, the projected area or surface. For a tentative working limit for the present, after considering the observed facts with both natural and artificial lighting, it appears probable that the comfortable limiting ratio lies between 1 to 100 and 1 to 200, and preferably (until we have some more evidence) the contrast in brightness of adjacent surfaces should be kept below the 1 to 100 ratio.

As an example, the practical effects of lifting contrast ratios to 1 to 100 or less in interior artificial lighting at the present time would be to limit the brightness of bowls and globes in locations where they must be faced continuously to an approximate value of 250 millilamberts (232 apparent foot-candles or 0·51-candle power per square inch) for rooms with light coloured ceilings and walls and with horizontal working-plane illumination of 4 foot-candles. The real criterion, of course, is the contrast of the globe or bowl against its possible background, rather than any fixed value of bowl brightness without regard to surroundings. Obviously, if the total light flux used in the room is increased, the brightness of bowls or globes may be increased in proportion without changing the contrast ratio. That is, if a given bowl in a given room with a given size lamp is within the safe ratio, an increase in the size of the lamp will not change the ratio. On the other hand, the changing to a darker colour of the surfaces against which the bowls or globes are seen would necessitate a reduction of the brightness of the bowls to keep within the safe contrast ratio-limit.

With daylight, the brightness of the sky is to be dealt with; and this can only be modified by shades or window glasses. Too great a contrast between the sky brightness as seen through the window and the brightness of the window casing and surroundings in the room, cause glare. The contrast will be most pronounced when the window surroundings receive but little light by reflection from the interior of the room. This is the case when the room is very deep in proportion to the window area, or when the ceilings, walls, and floor are dark. This is one good reason for certain school building regulations which have been proposed and enacted from time to time, requiring a minimum ratio of window area to floor area, although this is not the main reason for the regulation.

Diffusing glass should be avoided in the lower sashes of windows, not only because it introduces a brightness nearly equal to that of the sky on an unaccustomed portion of the retina, but also because of the contrast between the glass and the wall below the window. Such diffusing glass in the lower window sash is especially objectionable where the window sills are low.

In office lighting, glare from paper and desk tops is to be especially guarded against. The general method of treatment is the same as that which assures freedom from excessive contrast of brightness in the general illumination scheme. The same methods which tend to eliminate glare from light sources and surroundings, also eliminate glare from paper. When the eye is shaded from excessively bright surfaces, but the paper is not, as in the case of localized lighting with a shaded lamp, there is still likely to be considerable trouble, as it is almost impossible to so locate an individual desk lamp as to avoid this glare.

It is recommended that hereafter more attention than formerly be given in the engineering of interior illumination to the calculation of brightness contrasts. Such calculations may well be made a part of the preliminary work, just as the calculation of available, useful illumination has been for some time past.

Advice has just been received in London intimating that the Canadian Gas Association Convention and Exhibition will, it is arranged, be held in Quebec on Aug. 16 and 17 next.

LEGALITY OF GAS CONTRACTS IN WAR-TIME CONDITIONS.

In dealing last week with the recent litigation in which the Bordeaux Gas Company are appealing to the French Courts for a revision of the terms of their concession from the Municipality, we were able to record in the last paragraph [p. 76] the decision of the Conseil d'Etat, as reported in "Le Temps." The latter may now be supplemented by the text of the judgment itself, inasmuch as it is interesting to learn the view taken by a high judicial authority, even if of another country, in regard to a question which in war-disturbed times such as these is liable to arise with many commercial and industrial undertakings.

The judgment—again we are indebted to "Le Temps"—first affirms in general terms the relations normally existing between the parties, respectively, granting and accepting a concession. It holds that the obligations of both are definitely governed by the contract between them, until the contract expires; that the concessionnaire is bound to carry out the service under the conditions defined in the contract, and to recoup himself by the collection of the stipulated charges; and that the variation in the cost of raw materials, due to economic conditions, is a market risk which may be favourable or unfavourable to the concessionnaire according to circumstances, and stands among the contingencies to which the concessionnaire is liable—both parties being assumed to have made allowance for such risk in the calculations carried out by them before entering into the contract.

The judgment then proceeds to review the conditions brought into existence during the period of the war, among which it refers to the occupation by the enemy of the chief coal-bearing areas on the Continent, and to the difficulty of maritime transport resulting even more from the requisition of vessels than from naval warfare. These circumstances, it declares, have led during the course of the war to an increase in the price of coal to a degree which not only is exceptional in the sense in which the term is usually employed, but causes an increase in the cost of the manufacture of gas which in a measure is beyond any calculation, and certainly exceeds the extreme limits which could have been anticipated by the parties at the time of the concession. These circumstances, it is held, completely upset the economic balance of the contract. The Company are entitled to claim that they cannot be held responsible for the maintenance under the prevailing abnormal conditions of the service for which they assumed responsibility only in the circumstances contemplated at the time of the concession.

From these considerations it follows that if the Company are wrong in claiming that they should not be bound to bear any increase in the price of coal above 28 frs., it would be quite excessive to admit that the stipulated prices for gas are applicable exactly as they would be in the case of a risk such as is ordinarily run in commercial enterprises. On the contrary, it is necessary to discover a solution of the temporary situation which considers both the interests of the public (by whom the maintenance of the Company's service is required) and the special conditions under which the terms of the contract are not normally applicable. In other words, it is requisite to determine on the one hand that the Company should be made responsible for maintaining their service, and, on the other, that they should be called upon to bear, during this period of transition, only part of the burden imposed upon them by the *force majeure* of the national circumstances—viz., such a share as a reasonable interpretation of the contract permits of allotting to them.

In accordance with this decision, the Conseil d'Etat, as already reported, have annulled the previous judgment and have referred the case back to the District Court. Unless the parties can come to an agreement as to the terms on which the Company shall continue their service in the exceptional circumstances, the latter Court is to determine the amount of the indemnity to which the Company are entitled—the Municipality of Bordeaux bearing all the cost of both actions.

NOTES ON BYE-PRODUCT COKING.

[Communicated.]

The Effect of Salty Coals on Fire Bricks.

No one who has had any experience of bye-product coking at a plant carbonizing salty coals will deny the importance of the subject of Professor Cobb's address at the last meeting of the Coke-Oven Managers' Association. It is without a doubt the most harassing problem which the coke-oven manager has to face, and the solution of it will be the most welcome news both to brick users and to brick makers. Unfortunately, however, after a very careful study of Professor Cobb's paper, one has the feeling that, after all, coke-oven walls will be corroded as of yore. With regard to the cause of corrosion, from the purely theoretical point of view Professor Cobb's hypotheses fit in remarkably well with the experience of most coke-oven managers, and it is at least encouraging to think that the real cause of the chemical reactions in corrosion are now fairly well understood, and are distinctly traceable on theoretical lines. Since the early days of bye-product coking,

corrosion of the brickwork has been the trouble most often met with as far as the ovens are concerned. In Germany, as well as in this country, certain districts appear to enjoy complete immunity from the trouble, whereas in others walls have to be rebuilt in under twelve months. It has been known also for a considerable time that, when corrosion takes place, there is a large increase in the alkali content of the brick at the surface of corrosion. It has apparently not been sufficiently realized in the past that a small variation of temperature in the oven may affect the rate of corrosion very much indeed. In the case of ovens mentioned by the President, a difference in the average working temperature of only about 50° C. was responsible for lengthening the life of the brickwork by nearly 100 per cent. As Professor Cobb rightly pointed out, in all investigations of the character he had made, a number of particularly anomalous cases came to light, and a very good purpose would be served if all experimental investigations on matters of this and a similar nature could be collated upon something like standard lines, so that adequate and reasonable comparisons between different cases could be made. Now, at any rate, that we have had put before us on a fairly definite basis the factors principally operating in bringing about corrosion, and also that we have had indicated in a general way at least the direction in which we must look for a remedy, it is to be hoped that the matter will be tackled in a thoroughly systematic way; and the writer hopes that Profesfor Cobb, in conjunction with those who are interested in the purely practical side of the industry, will be able to announce in the near future that corrosion is a thing of the past. To achieve such a result, co-operation on an extended scale is required, as full and complete analyses of coal and bricks are necessary.

It would come as a surprise to many to see that the results obtained in the determination of the amount of soluble salt in coal by the ordinary method of water extraction gives an absurdly low result, as, up to the present time, this has been generally regarded by most coke-oven chemists as a sufficiently accurate method for the purpose. Previously determined salt contents must, therefore, be viewed with suspicion when they are being taken as a basis for comparison. The writer hopes, too, to see the brickmakers of this country lending a hand in the solution of the problem, though in a way, if corrosion can be overcome, their trade stands to be diminished. In the past, a few British brickmakers have offered a brick which they have claimed has a salt-resisting action, and one is inclined to wonder if this action can be substantiated on the lines of the arguments put forward by Professor Cobb. Systematic experimental work, with a full knowledge of all collateral data, is required if the problem is to be solved; and the brickmakers must equip themselves on a proper scale commensurate with the value of the work to be done. It has in the past frequently been the boast of brickmakers that they had no need to keep a chemist. For systematic working on the salt question, exact chemical knowledge is required, and full and accurate analyses of all materials are necessary. It is more than likely, too, that a small variation in the composition of a brick may have considerable effect on the ultimate power of the brick to withstand corrosion.

In his address, Professor Cobb paid particular attention to the reaction taking place between the iron in the firebrick and the salt. In the writer's opinion, this reaction is a very important one, and its action may be far-reaching. The chlorine of the salt has a rapid action on the iron of the brick, resulting first in the formation of chloride of iron, and then, given the proper conditions, the conversion of this into oxide of iron. It can also be shown that ferric chloride is actually volatilized from the brick. If, therefore, there is much iron in the brick, and at the same time conditions are favourable for the production and volatilization of ferric chloride, disintegration of the brick is likely to occur with great rapidity. It seems, therefore, to be indicated that one main feature of a salt-resisting brick should be the comparative absence of iron. It is known, too, that the physical texture of the brick is an important factor. The question of moisture as a factor in corrosion must also not be overlooked. It may be only a coincidence, but nevertheless it is a fact that in all cases where corrosion is most marked wet coal is carbonized. The washing and draining arrangements at many collieries are only rather primitive, and frequently the coal charged contains much more moisture than it ought to. Consequently, the faces of the bricks composing the oven walls are subjected to very great strain on account of the frequent contraction, due to the excessive cooling of the face of the brick every time the oven is charged. Careful attention to the moisture content will considerably minimize corrosion, even in the case of salty coals.

Professor Cobb's paper has undoubtedly aroused great interest in the bye-product coking industry; and it is to be hoped that the ultimate result will be the evolution of a brick which will satisfactorily resist the corrosive action of salt.

Enemy Businesses to be Wound-Up.—Among the latest orders made by the Board of Trade under the Trading with the Enemy Amendment Act, 1916, requiring enemy businesses to be wound-up are the Northern Union Mining Company, of Quayside, Newcastle-upon-Tyne (coal mining), and the Maschinenfabrik Augsburg Nürnberg, A.G., of Tothill Street, S.W. (manufacturers of gas-engines, &c.). The total number of businesses so dealt with has now reached a hundred.

THE APPLICATION OF ELECTRICITY TO EXHAUSTER DRIVING.

By H. C. Widlake, M.J.Inst.E., of the Plymouth and Stonehouse Gaslight and Coke Company.

The operation of exhausting plant by means of electric motors is a subject on which very little practical data are available; and in placing these notes before the readers of the "Journal," the author desires to explain that they represent the general considerations which, in his opinion, should be carefully investigated before deciding to extend the use of electricity in the direction indicated.

The exhauster has been aptly described as the "heart of a gas undertaking," and engineers as a whole have been reluctant to place so vital a unit of their plant under the charge of a power which, however applicable for a host of other purposes, leaves (at first sight) much to be desired when considered in connection with this particular function; and there exist in their minds grave doubts as to whether such a step would be accompanied by the same degree of success and satisfaction which has attended the application of the electric drive to other units of their plant in regard to which the conditions of service are not so exacting as those under which an exhauster operates.

It is generally recognized that the first steps towards economy and efficiency in working lie in the direction of the abolition of separate isolated power generating plants about a works, and the production of all the power required in bulk in a centrally situated generating station from which transmission lines radiate to the several points where a demand for power exists, and the conversion of the electrical into mechanical energy at these points by means of electric motors.

Modern gas-works, with their many power-using machines, scattered in many cases over a wide area, offer an ideal subject for the practical demonstration of this theory; but the interests of the undertaking cannot be served by the haphazard dumping-down of electric motors all over the place irrespective of conditions of working, situation, load factor, and intermittency of operation. Such injudicious "modernization" can only be characterized as a disastrous policy, too often recommended by interested parties whose knowledge of the conditions pertaining in gas-works is *nil*, and whose main interest is the fingering of the middleman's profit on the sale of electrical apparatus. It is a strange, though nevertheless true, fact that "engineers" of this sort have in some cases a lot to do with the electrification of a works; and it is no uncommon thing to find an undertaking literally cursed with a plant whose limitations and general unsuitability are only discovered when the engineer decides to seriously avail himself to the full of the advantages of electrical driving.

The right time for the consideration of the question of driving the exhausters by means of electric motors is when the entire question of the electrification of the works power plant is before the engineer; and it then becomes a very simple matter to instal generating plant which, lock, stock, and barrel, will meet any demand, however exacting, which in the future may be made upon it. But when the question crops up at a later date, and owes its origin probably to the fact that there is an electrical generating plant on the works, it may be discovered that the arrangement of plant which did well enough for the operation of stoking and coal and coke handling machinery is such as to quite prohibit its being entrusted, in its existing state, with the duty of driving the exhausters; and extensive alterations may have to be undertaken in order to render it suitable for the new purpose to which it is proposed to apply it.

The following are the factors which should be taken into consideration in connection with any proposal to apply electrical driving to exhausting plant:

A.—The condition, type, and general arrangement of the generating plant from which it is proposed to draw the necessary supply of electrical energy.
B.—The nature of the supervision under which this plant operates.
C.—The reliability of the electrical motor as compared with the steam or gas engine which it is proposed to abolish.
D.—The degree to which the interests of economy will be served by such an alteration.

It is proposed to deal with these factors separately.

Type and General Arrangement of Generating Plant.

In the first place, it is essential that the generating plant from which it is proposed to draw the supply of electrical energy for driving the exhauster motors should consist of a good make of modern engines and dynamos, and should be maintained in first-class condition. Sufficient plant should be provided to permit of one set being always kept as a stand-by (whether an accumulator battery is installed or not) and ready to take the load at a couple of minutes' notice.

As regards the type of prime mover, the modern gas-engine has attained a high degree of reliability, and is replacing the steam-engine in all branches of the engineering industry. In previous contributions on the subject of electrical power plants in gas-works, the writer has strongly advocated the use of gas-engines

for driving the works power generators, on grounds of reliability, economy, low attendance charges, simplicity, and last, but not least, general policy. The use of gas-engines for this purpose is a strong weapon in the hands of the undertaking which is up-against electrical competition and which has a large number of power consumers on its district of supply.

The load provided by the electric motors on an electrically operated gas-works plant is a varying one, and is liable to cause considerable fluctuations in the bus-bar pressure unless the generators are of a type which can automatically maintain an even bus-bar pressure over all conditions of load. The shunt-wound machine is utterly unsuitable for this class of work, and fully compounded generators should be installed. If these machines are obtained from a reputable firm of manufacturers, they will be found capable of maintaining an even bus-bar pressure irrespective of load variations without the necessity of either hand regulation or altering the positions of the brush rockers.

The maintenance of an even bus-bar pressure is essential to the satisfactory working of electrically driven exhausters; and while this can be accomplished by the use of a suitable type of generator, the employment of a battery of accumulators is a valuable asset in this connection, and will enable the plant to operate at a much more economical load factor than would be otherwise possible.

Use of Accumulators.

From neither the commercial nor the engineering point of view can the accumulator battery be regarded as a sound proposition when considered in the light of an actual stand-by, as in any case its sphere of activity is confined to a few hours; while its cost would probably exceed that of a generating set of equal continuous output. The provision of a judiciously rated set of accumulators can, however, largely contribute to low maintenance and running costs on any "D.C." power plant, and is a particularly valuable asset where motor-driven exhausters are employed, on account of the steadying effect which its employment has upon the bus-bar pressure, which is apt to vary considerably with the fluctuations in the power load, even where compound-wound generators are installed. The battery, when "floating" on the bus-bars—that is to say, connected-up in parallel with the main generators—automatically responds to all load variations, discharging to the line at times of heavy demand, and thus helping the dynamos over the peak-loads, and, conversely, drawing a charging current from them at times of light load when the pressure tends to rise, and thus providing a steady load at a time when the machines would otherwise be running light, and consequently operating at a poor load factor.

The use of the battery also enables the main machines to be shut-down at those perfectly regular intervals of light load which occur on all gas-works, and during which it would otherwise be necessary to keep a comparatively (having regard to the load) large set running on an uneconomical load. Generally speaking, its employment, as outlined above, has a steadying effect on the entire plant. It exercises a valuable cushioning effect in respect to the load variations, while it permits of the running machinery being shut-down not only during periods of light loads, but for the carrying out of those small adjustments and attentions which have so large an effect on the reliability and the running costs of a plant, but which, in the absence of a battery, are so prone to be postponed indefinitely, because of the natural reluctance to start a job on a set which may be required at any moment.

This argument does not, of course, apply to installations having a large reserve of stand-by plant; but on works having (say) three generating sets, of which two are generally kept running while the third is kept ready as a stand-by, it is a factor which must have quite an appreciable psychological influence upon the engineer in charge of the plant and the fitters who may be engaged upon the work of maintenance. When, in the case outlined above, any small repair is being carried out on the third set, the men so engaged will be always handicapped by the disturbing and uncomcomfortable conviction that the machine upon which they are working may be required at any moment, and, as a result, will be actuated by a desire to get the work finished and report the set ready for running at the earliest possible moment. In short, it is impossible to tell a fitter that he has at least (say) a couple of clear hours to carry out a certain job, and the man with the above-mentioned conviction at the back of his mind will never put the same quality of workmanship into his job as he would if this disturbing factor were not present, as would be the case if a medium-sized battery were installed.

Switch Gear.

The next most important factor upon which literal continuity of supply must depend is the type of control gear by which the generators are regulated, and through which the output of electrical energy passes out to the various circuits. The plant usually installed for the operation of stoking machinery, elevators, conveyors, and telphers has in the past been of a rather primitive character in this respect, inasmuch as though it could be trusted to give reliable and continuous service, the general arrangement of the switch gear is usually such that there is the ever-present possibility of the supply being interrupted by the legitimate action of the very apparatus which is installed for the purpose of protecting the dynamos against overloads and short-circuits on the distributing system. On plants employed on the work outlined above, these interruptions are regarded as inseparable from the use of electrical power, and are taken, as are also pressure variations, in a philosophic manner by those responsible for the running of the various units of the plant. But in those cases where electrically driven exhausters are employed, continuity in the supply of electrical energy, in the most literal sense of the word, is the very first essential; and unless this condition can be fulfilled, there should be no question of applying electricity for the purpose.

The installation of electrical plant is on most gas undertakings the direct outcome of the purchase of an electrically operated stoking machine or telpher; but the engineer who looks ahead realizes that there are several purposes, apart from this primary one, to which in the near future he can advantageously apply the electric drive. He therefore lays down a plant rated upon the basis of these purposes, so far as he can foresee them. In this manner he kills two birds with one stone—namely, he gets rid of some old steam eaters, and in so doing provides an economical load factor for the new generating plant.

Now where the load consists of the machines mentioned above, there is no need for that absolute continuity of supply which is so essential where electrically driven exhausters are employed. For instance, the falling of a generator circuit-breaker or the blowing of a fuse on an overload or a short-circuit is of little moment, and simply means that the various machines will be stopped for the short period necessary for the replacement of the fuse or breaker as the case may be. Where, however, exhausters form a portion of the load, such interruptions cannot be permitted; and the generating plant must be so arranged as to ensure continuity of supply to the exhauster motors under all conditions of external irregularities. The degree of reliability essential in the actual generating plant has already been outlined; and, given these conditions, there is not much fear of the supply failing as a result of trouble in the actual machines themselves. The whole question now turns upon the switchgear; and it is essential that this should be so arranged as to render it impossible for the occurrence of an external fault to cut off the supply to the exhauster motors.

The falling of a dynamo circuit-breaker on an external fault or overload always means a dislocation, of however short duration, of those processes to which electrical driving is applied; *and even though it is never intended to include the exhausters under this heading, there is no reason why the generating plant should not be installed in such a manner as to localize the effects of such faults and enable them to be handled without causing interruption all over the works.* It is simply a case of having the plant designed, selected, and installed by a man who knows his business, and is sufficiently conversant with gas-works practice to realize the inconvenience which these interruptions cause, and to recognize the fact that the day may come when the class of load will be such as to make it imperative that the supply of electrical energy from the main dynamos must be absolutely and literally continuous and quite free from the possibility of interruption due to the legitimate action of the protecting switch gear.

The practice of installing overload circuit-breakers on the main generator panels cannot be regarded as either a good, or even necessary, procedure provided an adequate degree of individual protection is secured on the different circuits. The first line of defence, so to speak, is afforded by either fuses or circuit-breakers on the motor starting panels about the works; while the feeder lines, from which the motors draw their respective supplies of energy from the main distribution board bus-bars, are similarly protected on the panels of that board. If, in the face of these appliances, there still exists the necessity for further automatic protection on the dynamo board, it is a sure sign that the electrician in charge of the plant is qualifying for the "Order of the Boot;" and the wise chief will invest him with this decoration before he puts the plant on the scrap heap.

Apart from any overload protection on the dynamo panels, there are two or four (according to whether the "S.P." or "D.P." system is installed) protective devices between the dynamos and the motors; and a man who would let these devices get into such a state of disrepair as to render them inoperative, would also let the dynamo breakers, if installed, fall into a corresponding state of inefficiency.

On a well-designed system, the protection of the motors and the distribution lines will be provided by the appliances to which reference is made in the preceding paragraph—such apparatus being quite distinct and separate from the appliances provided for the protection of the generators themselves; and the latter devices may safely be of a type which will only come into operation upon the occurrence of an internal fault in a dynamo. This requirement is met by the use of reverse current circuit-breakers, which, in the event of a fault occurring on a dynamo running in parallel with either another dynamo or a battery, will automatically disconnect the machine from the bus-bars. If overload devices be fitted on the dynamo panels, it is quite possible that a bad fault on a feeder will throw out both these switches as well as the switch on the faulty feeder circuit, and so will cause a shut-down which cannot be termed unavoidable.

The use of reverse current-breakers on the dynamo board in conjunction with suitable overload devices on the distribution board, provides an adequate degree of protection, and ensures that only in the case of an internal fault on the dynamos themselves will the bus-bars become dead. Such a failure can only be described as unavoidable; but dead bus-bars, as a result of external or feeder troubles, are certainly avoidable, and can be prevented by the judicious selection of suitable switch gear.

(*To be continued.*)

GAS IN THE INDUSTRIAL CANTEEN AND KITCHEN.

Examples of Installations by the Richmond Gas Stove and Meter Company

THE industrial canteen has come to stay; and in the modern canteens gas equipment largely predominates. The first part of this statement has about it an absolute confidence, and that confidence is based upon experience and report—the authoritative report of the highly-qualified Committee on the Health of Munition Workers, over which Committee Sir George Newman, M.D., presides. "The practice" [that is, of providing industrial canteens], say the Committee, "has abundantly justified itself from a business and commercial point of view; and, in the opinion of the Committee, the time has come for a large extension." And, again, "they are convinced that, in the highest interests of both employer and worker, proper facilities for adequate feeding arrangements should be available in or near, and should form an integral part of, the equipment of modern factories and workshops." We agree.

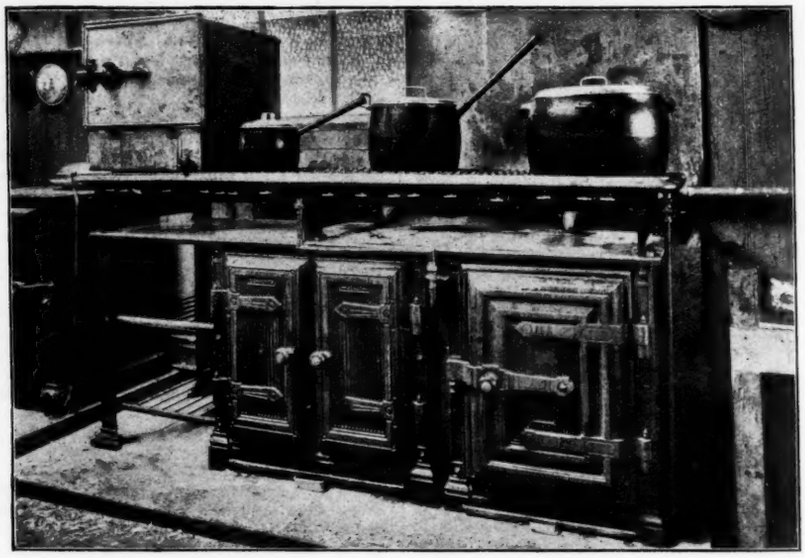


FIG. 1.—PART OF A KITCHEN AT A "Y.M.C.A." CANTEEN.

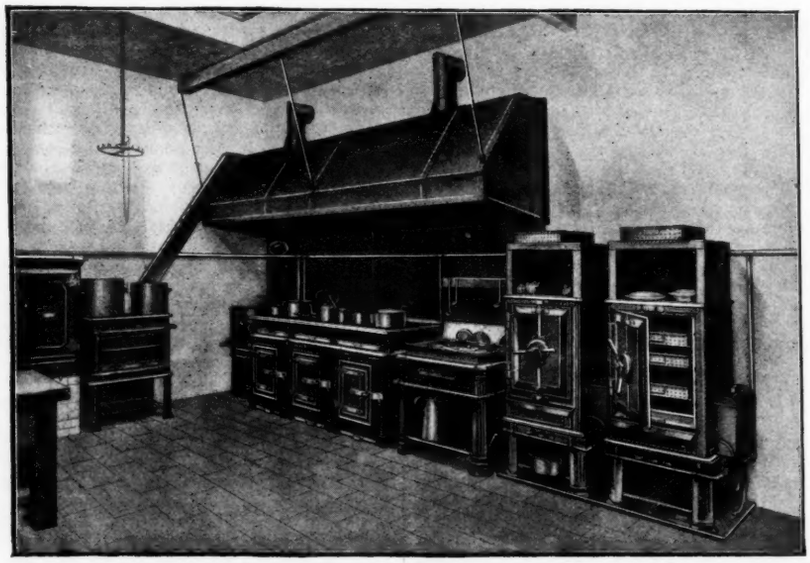


FIG. 2.—PORTION OF A KITCHEN INSTALLATION CARRIED OUT FOR H.M. OFFICE OF WORKS.

THE CANTEEN PROMOTES EFFICIENCY AND PRODUCTIVITY.

There is no question about it that the war is going to have an important effect in revolutionizing the methods of our industrial system; and not the least part in the process of revolution is the permanent attention that is going to be paid to matters affecting the efficiency and the productivity of the workers, and through the workers of the factories of the country. This enhancement of productivity is a matter not only of industrial, but of nationa importance; and it was one of the main points in the many featured and thoughtful address that Mr. H. M. Thornton, as Chairman of the Council, delivered just recently to the Society of British Gas Industries. The canteen, it has been proved, is one means—and a very valuable means—of contributing to both manual and manufacturing efficiency and productivity. Prior to the war there had been pioneer work by factory owners in providing kitchens and meal-rooms—initially for the convenience and comfort of workers, owing to residence a distance from the place of employment; and it is very significant that, when high-pressure industrial activity spread through the country, owing to the huge requirement for munitions of war, factory canteens and kitchens were almost immediately and extensively adopted. This was no haphazard or thoughtless choice or movement. It was a deliberate part of the plan to promote time economy and works' and man efficiency. And it may be accepted as axiomatic in a matter of this kind that what is good in this direction in time of war must be good in time of peace.

THE PROMOTION OF HEALTH AND FITNESS.

In this connection manufacturers and gas engineers should study, in the interests of their respective concerns, the case presented for industrial canteens by the Committee on the Health of Munition Workers; for, apart from accrued experience, the case is unassailable. The Committee say there is an overwhelming body of experience which proves that productive output in regard to quality, amount, and speed is largely dependent upon the physical efficiency and health of the worker. In its turn, physical fitness is dependent upon nutrition. The human body calls for a

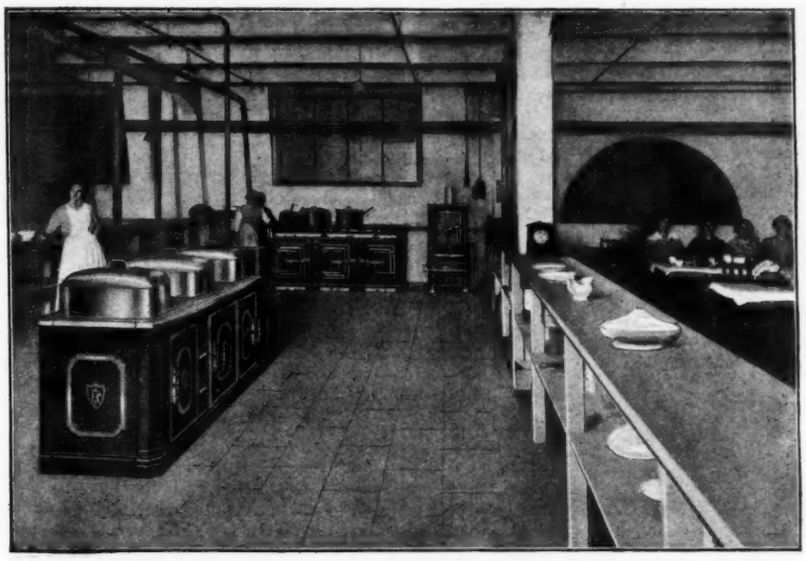


FIG. 3.—TYPICAL WORKS' KITCHEN FOR 350 EMPLOYEES.

constant supply of food—first, for its growth, for the building-up of its tissues, and for repair, and, secondly, as fuel for the production of heat and energy. These are truths which cannot require accentuation or qualification under any circumstances. But one of the important difficulties in the way of adequate and properly cooked food for workers has been due to the necessity for having meals away from home; and unsuitable and inadequate food, and (in numerous cases) indifferent cooking, have been responsible for much of the ill-health among, and some of the diseases that permanently undermine the physical condition of, industrial workers. Experience further proves that among those workpeople who make use of the canteens already existing in factories, there is a lessened disposition to alcoholism, which alone results in engendering increased harmony and efficiency. Cheap, good, and well-cooked food and comfortable surroundings form a potent counter-attraction to the public house. These are considerations that from the humane standpoint, as well as from the industrial and national, must not be neglected. Upon them, we have the Committee on the Health of Munition Workers remarking that the problem is the supply of food at low rates for large numbers of persons at specified times. Where large numbers of persons are employed, it does not appear to us that the problem is at all a difficult one, if the employer has both his own and his employees' interests at heart. Although there is no statutory obligation upon the employer, there is found from the health, business, and commercial points of view, an amplitude of justification for the provision of proper accommodation and the coincident facilities for feeding as an integral part of the equipment of modern factories and workshops; and, at quite moderate prices, a canteen can be made to pay, even with a limited number of workers. Of course, the larger the number of persons cooked for, the lower the *per capita* cost.

The height of favour to which industrial canteens have risen in connection with the war is testified by mentioning that they are to-day to be found in Government Arsenals, the New National Shell Factories, Naval Construction Works, the works of the principal Engineering Firms, Automobile and Cycle Makers, Aeroplane Factories, Ordnance Factories, Small Arms Factories, Shell Factories, Naval Air-craft Stations, "Y.M.C.A." War Buildings, and in hundreds of industrial factories.

The Nature of the Canteens.

There are two methods of equipping factory or workshop canteens or kitchens:

First, an equipment for supplying and cooking meals complete, providing hot non-alcoholic beverages, and supplying boiling water for washing-up purposes.

Secondly, an equipment for warming food brought in by employees, providing water for tea, coffee, or cocoa, and for washing-up purposes.

The experience is that the workers like the canteens and patronize them; but they would not do so if inconvenient and unattractive. On this point, the Committee are emphatic. They also advise that the canteens should be situated in or near the works. They should be maintained scrupulously clean, be light, and well ventilated, and in the winter be suitably warmed. To these points careful and continuous attention is necessary. The Committee's experience also leads to the recommendations that the kitchen should be properly equipped, and furnished with the necessary scullery, pantry, and store rooms, and should be separated from the dining-room by a servery and bar. In addition, for those workers who bring their food from home, accommodation should be provided for its warming or cooking. Patronage of the canteen should not be made compulsory under any circumstances—patronage will be certain to extend on the merits of the canteen itself.

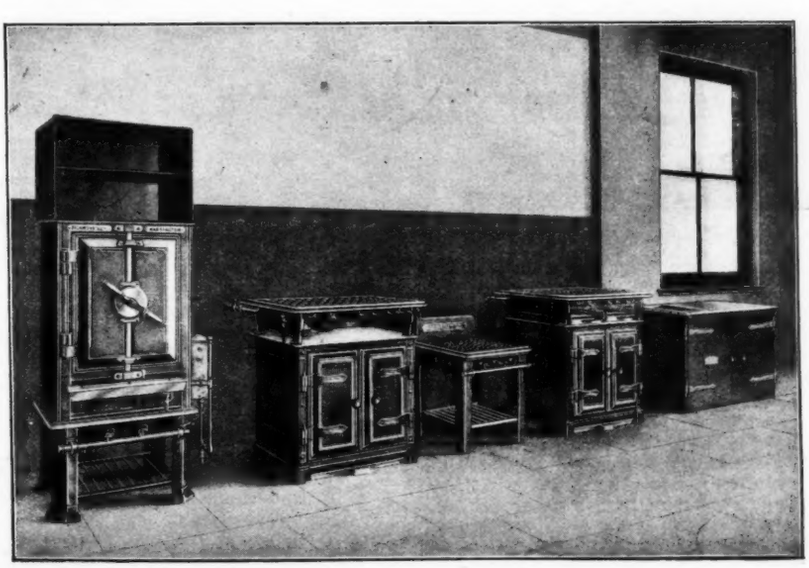


FIG. 4.—PART OF KITCHEN IN WHICH 800 MEALS A DAY ARE PREPARED.

The Convenience of Gas for Canteen Work.

For the canteen there is no form of fuel that is so convenient as gas, and no type of apparatus so suitable as that in which gas is the fuel. In many of the installations that have been made in connection with war work, no other fuel was possible, and certainly no other form of fuel so readily available, and capable of being so quickly brought into service. In some cases, too, where employers were hesitating between different fuels, it has been found that the argument of the patriotic duty of consuming gas for the sake of the residuals has had a decisive effect, and the experience has been that manufacturers, once realizing the importance of this subject to the nation were very willing to respond. This argument—gas salesmen should note this—needs to be more widely circulated among manufacturers and the public generally, many engineer that the advantages of such installations are not all on the side of the manufacturers and workers.

In the first place, attention is called to—

A canteen installed by the "Y.M.C.A.," to provide meals for workers at the docks of one of the west-coast seaports. The illustration (fig. 1) shows only a portion of the kitchen—viz., a treble oven range for roasting and baking and large hot-plate for boiling.

In the kitchen of the "Y.M.C.A." headquarters in a large Lancashire town, there is gas apparatus providing meals for many hundreds of men daily. The apparatus includes a large central range, carving-table and hot closet, steamers, boilers, fish fryers, grillers, &c.

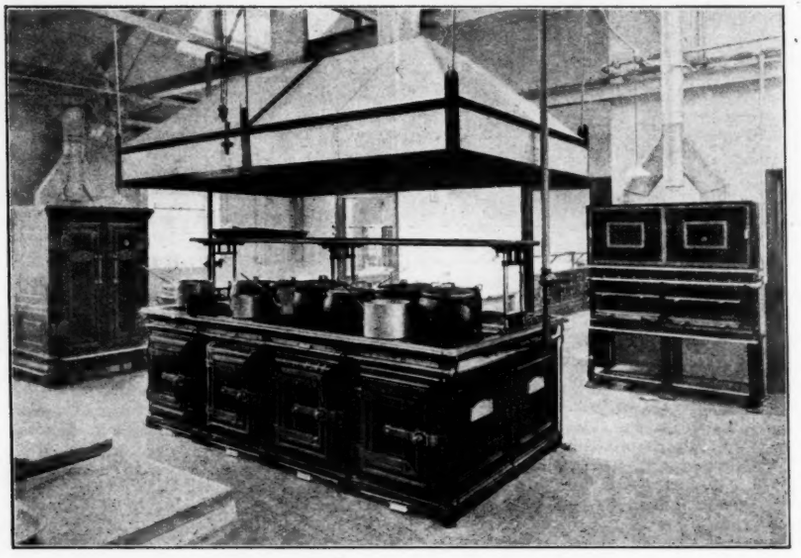


FIG. 5.—INSTALLATION CARRIED OUT FOR H.M. OFFICE OF WORKS, FOR PROVIDING DINNERS AND TEAS FOR 2,000 WOMEN EMPLOYEES.

FIG. 6.—SHOWING QUICK CONVERSION OF AN UNOCCUPIED ROOM TO COOKING PURPOSES.

of whom have not yet realized the dependence of the supply of high explosives on the consumption of gas.

Some Sample Canteen Gas Equipments.

The size of the industrial canteen, of course, depends upon requirement, and upon the requirement depends the character of the equipment. Whatever the size, whatever the number of people to be catered for, gas apparatus means economy of time and money, reliability, and efficiency in operation; and all these points will appeal to the manufacturer whatever his industry.

We have before us a large number of particulars of canteen installations by the Richmond Gas Stove and Meter Company, Limited. From these we have made a selection to show [some of them are illustrated] the range of the equipment that is necessary according to requirement; and these will indicate to the gas

Next there is a portion of a kitchen installation erected by the Richmond Company for H.M. Office of Works; provision being made for complete meals for a large number of workpeople. The apparatus shown in fig. 2 (left to right) embraces hot closet, griller with urns on top, stock-pot on stand, treble range, fish fryer, and two vegetable and pudding steamers.

In fig. 3 we have a typical works kitchen for 350 employees, fitted with "Richmond" cooking apparatus including treble oven range, vegetable and pudding steamer, hot closet, carving-table, and stock-pot.

The equipment for a small kitchen for about 100 workpeople comprises double-oven range, hot-plate, and "Singlus" instantaneous water-boiler for tea making.

In the next case, 800 meals a day are prepared in the kitchen, part of which is illustrated (fig. 4), and which is equipped throughout with the Richmond Company's apparatus.

Some splendid work is found in a kitchen installation made by the Company for H.M. Office of Works (fig. 5). The arrangements for providing meals are very complete here; and no less than 2000 women employees are supplied with dinners and teas daily.

The equipment in the kitchen at one of the largest Post Office buildings in the country supplies complete meals daily for hundreds of postal servants.

The next example is not an ideal installation; but it shows how an unoccupied room was converted in a few hours into a kitchen (fig. 6). In addition to the ranges two "Ironclad" circulators (for providing large supplies of hot water) were installed.

These installations are sufficient to exemplify the substantial character of the work carried out by the Richmond Company in equipping industrial canteens up and down the country. They indicate, too, the firm establishment of the canteen as an essential of the industrial system. Now from the broadened experience obtained through the need for the highest manual efficiency in the high-pressure work demanded by the war, gas engineers and salesmen should set out with the deliberate intention of trying to convert to the all-round advantages of the canteen or kitchen and meal-room all manufacturers whose workpeople have not their homes concentrated about the works. The arguments for them are complete; and they are fortified by a large body of practical experience.

A Month's Menu and Prices.

It may be of interest if we append to this article the menu for one month (together with the tariff) for a large, gas-equipped canteen at an important works in the North of England:

Menu.

Monday: Beef steak pie. Parsnips and turnips, boiled potatoes. Sultana pudding or sago pudding.
Tuesday: Roast mutton. Haricot beans, boiled potatoes. Apple pudding or rice pudding.
Wednesday: Roast beef. Haricot beans, boiled potatoes. Jam roll or sago pudding.
Thursday: Roast beef. Cabbage, boiled potatoes. Currant pudding or rice pudding.
Friday: Roast mutton. Peas, boiled potatoes. Cokernut pudding or tapioca pudding.

Monday: Roast mutton. Onion sauce. Carrots, turnips, boiled potatoes. Golden syrup pudding or sago pudding.
Tuesday: Roast pork. Apple sauce. Carrots, boiled potatoes. Rice pudding or jam roll.
Wednesday: Beef steak pie. Brussels sprouts, boiled potatoes. Apple pudding or ground rice.
Thursday: Roast beef. Haricot beans, boiled potatoes. Apple tart or tapioca pudding.
Friday: Roast mutton. Peas, boiled potatoes, currant pudding or sago pudding.

Monday: Roast mutton. Cabbage, boiled potatoes. Rice pudding or sago pudding.
Tuesday: Stewed steak. Cabbage, boiled potatoes. Sago pudding or jam roll.
Wednesday: Roast beef. Haricot beans, boiled potatoes. Tapioca pudding or apple pudding.
Thursday: Beef steak pie. Peas, boiled potatoes. Rice pudding or currant pudding.
Friday: Roast beef. Carrots, turnips, boiled potatoes. Sago pudding or cokernut pudding.

Monday: Roast mutton. Parsnips, turnips, boiled potatoes. Rice pudding or lemon pudding.
Tuesday: Steak and kidney pudding. Peas, boiled potatoes. Sago pudding or sultana pudding.
Wednesday: Roast beef. Cabbage, boiled potatoes. Tapioca pudding or jam roll.
Thursday: Potatoe pie and pickled cabbage. Rice pudding or apple pudding.
Friday: Roast beef. Haricot beans, boiled potatoes. Tapioca pudding or currant pudding.

Prices.

Staff. { Up to 25s. weekly . . . . 4d.
Over 25s. weekly . . . . 6d.
Workmen.—All Classes . 4d. without Pudding; 5d. with Pudding.
Girls . . . . . 3d. without Pudding; 4d. with Pudding.
Extra Pudding . . . . . 1d.
Cup of Tea or Coffee . . . ½d.
Employees take five tickets on Monday morning for the week.

The menu is excellent; and the prices are moderate. The results are those set forth in the early part of this article.

News has just been received of the death, at the age of 92, of the father of Mr. F. S. Cripps, Assoc.M.Inst.C.E., who is well-known as the author of works dealing more particularly with gas-holder construction. The deceased gentleman was the first one in Worthing to have his business premises lighted with gas about seventy years ago.

SWISS GAS ASSOCIATION.

Proceedings at the Annual General Meeting.

We have received a copy of the official report of the proceedings at the annual general meeting, held on Sept. 12 last, of the Swiss Association of Gas and Water Engineers. The meeting took place at St. Gall, under the chairmanship of M. Burkhard, the Manager of the Lucerne Gas-Works.

After declaring the meeting (which was the forty-second annua one held by the Association) open, the Chairman presented the report of the Council for the years 1913-14 and 1914-15. The report for the former period had been held back until now, owing to the disturbed conditions last year. The report records the thanks of the members to M. Roth, of Zürich, the Secretary of the Association and Manager of the Commercial Association of Swiss Gas-Works, for his invaluable services in securing the exemption of Swiss gas workers from military service, and in obtaining permits for the importation of anthracene oil, the sale of tar, &c. Unfortunately, he had been compelled to relinquish the secretaryship of the Association, which from July last had been in the hands of M. Escher, the Manager of the Zürich Gas-Works, assisted by M. Chastelain, the Chief Engineer of the Water and Gas Supplies of Lausanne.

Reviewing the work of the Committee during the two years, it is reported that the Gas and Water Section at the Swiss National Exhibition at Berne in 1914 was organized by M. Roth, assisted by M. Zollikofer, the Manager of the Gas and Water Works of St. Gall. A report prepared for the General Catalogue of the Exhibition stated that in 1912 about 220 Swiss parishes, with an aggregate population of 1,800,000, had supplies of gas, and that about 233,000 metric tons of gas coke had been produced in the country in the year. The Association had been represented at the opening ceremony of the Gas Exhibition at Munich in July, 1914, by M. Roth. Rules for the Swiss National Committee of the International Commission on Illumination had been discussed with the Swiss electricians; but the report observes that the war had obviously put an end to such international relations. The same remark is made in regard to the work of the International Committee on the Unification of Pipe Threads.

New statutes or rules for the Association, drafted with a view to increasing its membership and importance, had been passed at the previous annual meeting, and had already resulted in an increase of membership, of all classes, from 237 to 297. It had been decided that the Association's Inspector should for the time being undertake inspections of gas-works only in cases where they were absolutely necessary. The officers had been in touch with the Swiss National Accident Insurance Bureau with a view to improving the arrangements for gas-works employees. Schemes for publishing an official organ of the Association had been deferred, in view of the fact that the time of its members was already so fully occupied that they could hardly give to it the collaboration which would be essential for its success. The warm thanks of the Association had been accorded to Madame Weiss, of Zürich, for having presented to it the plans drawn up by her late husband for the new gas-works at Budapest. The plans were available for inspection by members. The Association was endeavouring to secure representation on the Council of the Swiss Society of Industry and Commerce.

The Association had lost, by death, last year one of its honorary members, M. E. Des Gouttes, formerly the Manager of the Geneva Gas-Works. The membership now comprised three honorary members, 114 collective members (works), 90 individual members, and 90 associates or external members.

The report having been presented and accepted, the accounts for the past year and estimates for the ensuing year were similarly presented and approved by the meeting. The following technical communications were then read and discussed: "The Development of the Water Supply of St. Gall," by M. L. Kilchmann of St. Gall; "The Development of the Gas Supply of St. Gall," by M. H. Zollikofer, the Manager of the Gas-Works; "Coal Tar and its Distillation," by M. Zollikofer; Novelties in the Water-Works at St. Gall," by Professor P. Ostertag, of Winterthur; and "Gas Fires," by Dr. E. Ott, of Zürich. An abstract translation of the last-named paper has already appeared in the "Journal" [Vol. CXXXIII., pp. 89, 151], and summaries of the contents of M. Zollikofer's papers, in so far as they present points of interest to English readers, will be given at an early date.

After transacting some other private business, the meeting decided, on the invitation of M. E. Meystre, that the Association should meet this year at Vevey.

Wales and Monmouthshire District Institution.—There will be a general meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers at Newport on Wednesday, the 24th prox., when a paper will be read by Mr. Thomas Canning, J.P., and the officers will be elected for the ensuing year. There will be a visit to the gas-works.

Scottish Junior Gas Association (Eastern District).—The annual general meeting will take place next Saturday, in the Heriot Watt College, Edinburgh, when (in addition to the submission of the report and accounts and the election of officers), a lecture will be given by Mr. John Baxter, M.A., of Cowdenbeath, on "Chemistry in Gas-Works," with demonstrations.

METHODS FOR DEALING WITH ARSENICAL SULPHURIC ACID IN THE MANUFACTURE OF SULPHATE OF AMMONIA.

By P. Parrish, of East Greenwich.

For some time now there has been a marked inadequacy of sulphuric acid, owing to the abnormal quantities which have been used in the manufacture of high explosives. Consequently, it is not surprising that many manufacturers hitherto using sulphuric acid have been compelled, through sheer stress of circumstances, to resort to the employment of other products. Even the gas-works and coke-ovens that have been regular users of sulphuric acid for sulphate of ammonia manufacture have been compelled to accept deliveries of a quality of "B.O.V."—the arsenical quality—with which for the most part they have been unaccustomed to deal in the past. Owing to the fact that the sulphide of arsenic which is formed in the saturator by the precipitation of arsenic by H S becomes associated with the sulphate, and that discoloration is thereby caused, the question has naturally arisen as to the best means of surmounting this difficulty.

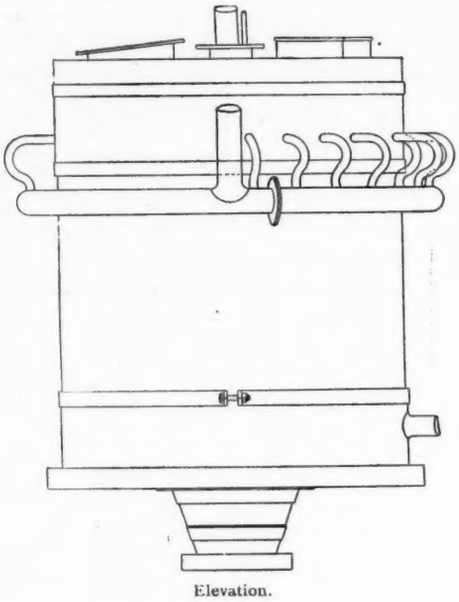
It is a moot point whether sulphate of ammonia containing small traces of sulphide of arsenic has any deleterious effect from a biological point of view as a manure. Judging by analogy, one would be inclined to say that the objections raised to an arsenical sulphate are exaggerated and not well-founded. Look at the large quantities of arsenical superphosphates which are used for manurial purposes with apparently no injurious effects. It is safe to say that 90 per cent. of the superphosphate made in this country is prepared from arsenical sulphuric acid. If no bad effects result from the use of arsenical superphosphate, the explanation will certainly be a curious one which suggests arsenical sulphate as injurious.

Be this as it may, there is no doubt that a discolored salt is not by any means as marketable as a good grey. It is, therefore, pertinent to inquire as to the best method by which a ready saleable good grey sulphate can be produced from arsenical sulphuric acid. Several methods suggest themselves.

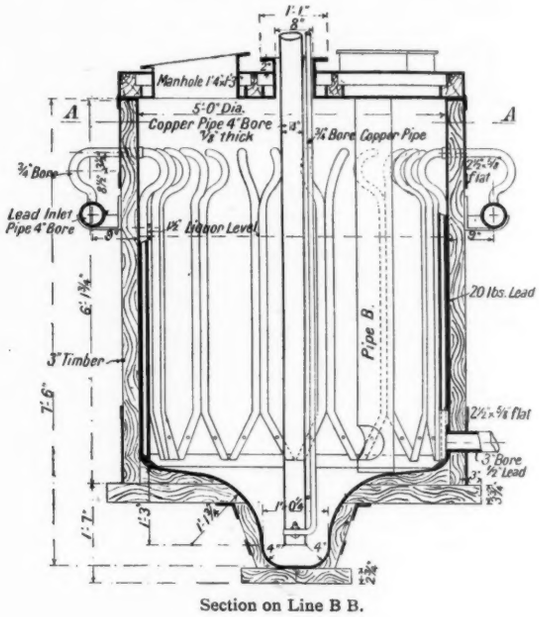
Shale Distillers' Method.

Firstly, one is tempted to ask why not adopt the method that the Scottish shale distillers employ, many of whom use arsenical "B.O.V." for the manufacture of their sulphate of ammonia. This method, as far as I recall, consists of working with an oil-film (say) of anthracene in the saturator—such oil-film serving the purpose of arresting the sulphide of arsenic and pyridine, &c. Once or twice each day the liquor is temporarily shut-off from the stills, and the saturator is reduced in strength by the addition of water, and the contents "boiled up" for a short time. After allowing a few minutes for settlement, it will be found that the scum or oily film has sunk to the bottom of the saturator, due to it being specifically heavier than the contents of the bath. Suitable provision is made for drawing off this scum. Prior to re-admitting the liquor to the stills, a further quantity of oil is added to the saturator, and the same process pursued again. In some cases, the oil is fed continuously in very small quantities; but the elimination of the pellicle or scum is as already described.

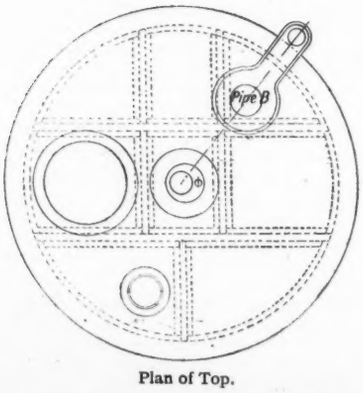
The periodic dilution of the bath and "boiling up" operation (apart from removing the sulphide of arsenic and tarry matter) also serves a useful purpose in removing the rock-salt which



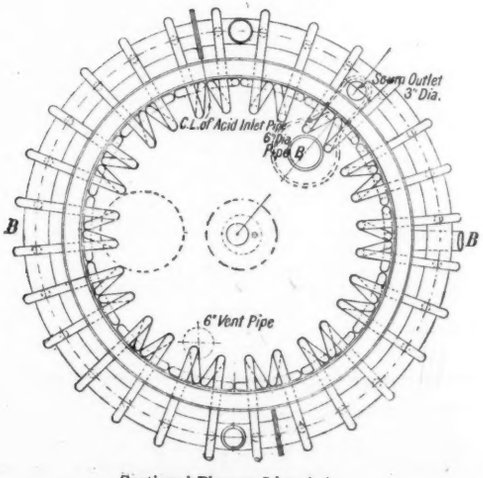
Elevation.



Section on Line B B.



Plan of Top.



Sectional Plan on Line A A.

FIG. 1.—SATURATOR FOR FIVE-TON SULPHATE PLANT, WITH SELF-SCUMMING ARRANGEMENT.

is apt to accumulate in all saturators. The salt made by the Scottish shale distillers commands a ready sale; and, although perhaps not as good in colour as that made from non-arsenical acid, there is little to which exception can be taken.

Closed Saturator with Self-Scumming Arrangement.

Secondly, some of the closed saturators in use to-day are provided with an automatic or self-scumming arrangement, as illustrated in fig. 1. This consists of a lead pipe about 4 to 6 inches diameter (according to the size of the saturator), which is taken almost to the bottom of the saturator—at all events, to a level equal to that of the perforations in the cracker pipe. This pipe emerges from the dome of the saturator into a circular open tray with a suitable standup, which is also provided with another 2-inch to 3-inch pipe for carrying away the automatically discharged scum. This arrangement can either be worked with or without an oil-film according to what experience of working reveals to be most desirable.

It should be remarked that when working such a saturator with arsenic-free acid, there is an appreciable scum of tarry matter continuously self-discharged, the removal of which certainly promotes the formation of a white salt. When working with an arsenical acid in such a saturator, the sulphide of arsenic formed in the bath becomes intermingled with the tarry scum, and is removed in the manner already indicated.

The scum is led by the pipe B (fig. 1) to a lead-lined tank, and is periodically washed with water; and any small quantity of sulphate of ammonia which is carried over with the scum is recovered and run into the mother-liquor well—the tarry matter and (in the case of the saturator being worked with arsenical acid) arsenic sulphide being removed to the tip.

The writer's experience with saturators provided with the scumming arrangement in question in connection with arsenical acids leads him to discountenance the use of an oil-film.

The sulphide of arsenic in such a saturator can be collected without the use of anthracene or other such suitable oils; and the absence of the latter certainly tends to produce a permanently better colored salt.

The Process of Dearsenication.

The third method is that of having recourse to the removal of the arsenic from the acid by the process known as dearsenication. This is a subject on which very little practical information exists. Whether this is due to an absence of experience, or to a disinclination to disclose practical working results, one can only surmise. At all events, it will not be out of place to deal somewhat broadly with this important aspect of sulphuric acid purification.

There are two qualities of pyrites from which sulphuric acid is manufactured—namely, non-arsenical pyrites and arsenical pyrites. The former quality is invariably of Norwegian origin. The latter is obtained from Spain and Portugal, and in a lesser degree from the Balkans and Greece. The Norwegian ores, although regarded as non-arsenical, are not absolutely free of arsenic. For instance, the well known Foldal ore contains varying small percentages of arsenic, according to the particular vein from which it is drawn. Several analyses which the writer has made of this quality of ore show an arsenic content of 0·01 per cent., and the 80 per cent. sulphuric acid produced therefrom contains about 7 grains of AS_4O_6 per gallon.

The term, "arsenic-free acid," has never been clearly defined. In some districts in the United Kingdom the phrase "commercially free of arsenic" implies an acid containing not more than one part of arsenic per 100,000; in other districts of the country, acid may be sold as arsenic free, and yet contain ten to twenty parts per 100,000.

The following table furnishes the arsenic content of several of the well-known arsenical pyrites used in the United Kingdom for the production of acid:

	Per Cent.
Esperanza	0·04 to 0·09 As.
Tharsis	0·2 ,, 0 3 As.
Rio Tinto	0·2 ,, 0·3 As.
Aljustrel	0·33 As.
Seville	0·5 to 0·6 As.
Mason and Barry's	0·5 ,, 0·6 As.
Pena (some qualities)	0·06 As.
Killingdal (some qualities)	0·2 As.

No one appears to have investigated at all fully or comprehensively the distribution of arsenic following the combustion of the pyrites in the burners of sulphuric acid plants. The writer has undertaken a little research work in this connection, but certainly not sufficient to enable him to speak with any degree of confidence or authority. From his investigations and experience, it would appear that 30 per cent. of the arsenic in an ore is to be found in the chamber acid; 20 per cent. in the cinders remaining unvolatilized; and about 50 per cent. in the Glover tower acid. Of course, due to constant circulation, the Gay-Lussac acid contains about the same percentage as the Glover acid; but, as its origin is directly attributable to the Glover acid, this does not affect the point at issue.

In support of the above statement, it may be interesting to give a representative analysis of a sample of the mixed chamber acids emanating from a plant in which Seville ore was burnt. Several analyses of the mixed chamber acids from this plant made at different periods showed a content of 0·17 per cent. of AS_4O_6 and 0·029 per cent. of AS_2O_5. Considering this in the light of the data furnished above, 100 tons of Seville ore contain 0·6 per cent. of arsenic, 30 per cent. of which finds its way to the chamber acid; and 100 tons of Seville ore contain 44 per cent. of sulphur, 3 per cent. of which is left in the cinders unconsumed. Thus 100 tons of Seville pyrites, on the basis just given, would yield 41 tons of available sulphur, and thus would produce:

$$\frac{41}{1} \times \frac{98}{32} \times \frac{100}{80} = 156{\cdot}8 \text{ tons of 80 per cent. of acid.}$$

Assuming a 96 per cent. yield is equal to 150·5 tons of 80 per cent. acid, which contains 0·18 tons of arsenic, the 80 per cent. acid contains 0·12 per cent. of arsenic.

This calculated content of arsenic approximates to that actually found by the series of tests to which reference has been made, and does at least afford some indication as to the distribution of arsenic.

Methods and Hints as to Working.

Take a gas-works or coke-oven plant which has decided on the elimination of the arsenic from the acid. It is advisable before designing a plant suitable to meet the special requirements in question, to arrive at some data. The composition of the waste gases from sulphate of ammonia plants manifestly varies with the composition of the gas liquor distilled. Gas-works, for the most part, are in the happy position of having a much stronger ammoniacal liquor to treat than the majority of coke-ovens. Few gas-works should have any occasion to deal with a liquor of less than 8 oz. strength, as determined by Wills's test, and many produce 10 to 12 oz. liquor. The factor for converting ounces strength by Wills's test to percentage of ammonia is 4·61.

Thus 8-oz. liquor (4° Twaddel) = 1·73 per cent. NH_3.
,, 10-oz. liquor (5° Twaddel) = 2·17 per cent. NH_3.

It may fairly be assumed that a gas liquor showing 10 oz. strength (5° Twaddel) produced by the carbonization of a Yorkshire coal will contain about 0·3 per cent. of total sulphur, and about 2·1 per cent. of total ammonia. The latter are to be taken as approximate figures, as it is conceivable that they are subject to considerable variation, according to the method of carbonization, and the extent to which the ammoniacal liquor is used as a purifying agent, &c.

The waste gases from the distillation of such a liquor should contain 40 to 50 per cent. of H_2S by volume; and assuming that 90 per cent. of the total sulphur is disengaged in the distillation process, and leaves the saturator in the form of H_2S, the quantity of waste gases can be calculated from these data.

A gas-works producing 5 tons of 25 per cent. sulphate of ammonia per day by the distillation of ammoniacal liquor of the analysis given should generate 3769 cubic feet of H_2S per diem [see calculation in Table I.]. Now to produce five tons of 25 per cent. sulphate of ammonia, theoretically, 4·51 tons of

Table I.

100 tons of sulphate contain 25 tons of NH_3
5 ,, ,, 1·25 ,, ,,
10 oz. (5° Tw.) liquor contains 2·1 per cent. NH_3.

Therefore: $\frac{1{\cdot}25 \times 100}{2{\cdot}1} = 59{\cdot}52$ tons of 5° Tw. liquor must be distilled to produce 5 tons of 25 per cent. sulphate.

$$59{\cdot}52 \text{ tons } 5° \text{ Tw. liquor} = \frac{59{\cdot}52 \times 2240}{10{\cdot}25} = 13{,}007 \text{ gallons.}$$

Assume 96 per cent. yield of sulphate $= \frac{13{,}007 \times 100}{96} = 13{,}549$ gallons 5° Tw. liquor to be distilled to produce 5 tons of 25 per cent. sulphate.

Now, 13,549 gallons (*i.e.*, 62 tons) liquor contain $\frac{62 \times {\cdot}3}{100} = 0{\cdot}186$ tons of sulphur, 90 per cent. of which goes to form $H_2S = 0{\cdot}1674$ ton.
1 cubic foot of H_2S weighs approximately 42½ grammes, or 10 cubic feet of H_2S weighs about 1 lb.

Therefore: $\frac{1674}{10{,}000} \times \frac{2240}{1} \times \frac{10}{1} = 3769$ cubic feet H_2S from the liquor distilled per day.

Table II.

$$2NH_3 + H_2SO_4 = (NH_4)_2\,SO_4$$
$$34 \qquad 98$$

5 tons of sulphate contain 1·25 per cent. NH_3.

Therefore: $34 : 1{\cdot}25 :: 98 : x$
$80 : 100$

$x = 4{\cdot}51$ tons of 80 per cent. acid.

Table III.

$$AS_4O_6 + 6H_2S = AS_4S_6 + 6H_2O$$
$$396 \qquad 204$$

(4 As. = 300)

Quantity of As. in the 4·75 tons of 80 per cent. acid $= \frac{4{\cdot}75 \times {\cdot}2}{100} = 0{\cdot}0095$ ton, or 21·28 lbs.

Therefore: H_2S required to precipitate the 21·28 lbs. arsenic in the 4·75 tons of 80 per cent. acid = $300 : 21{\cdot}28 :: 204 : x$
$x = 14{\cdot}47$ lbs. H_2S.

As 10 cubic feet H_2S at N.T.P. weigh about 1 lb. 144·7 cubic feet will be required to dearsenicate the acid in question.

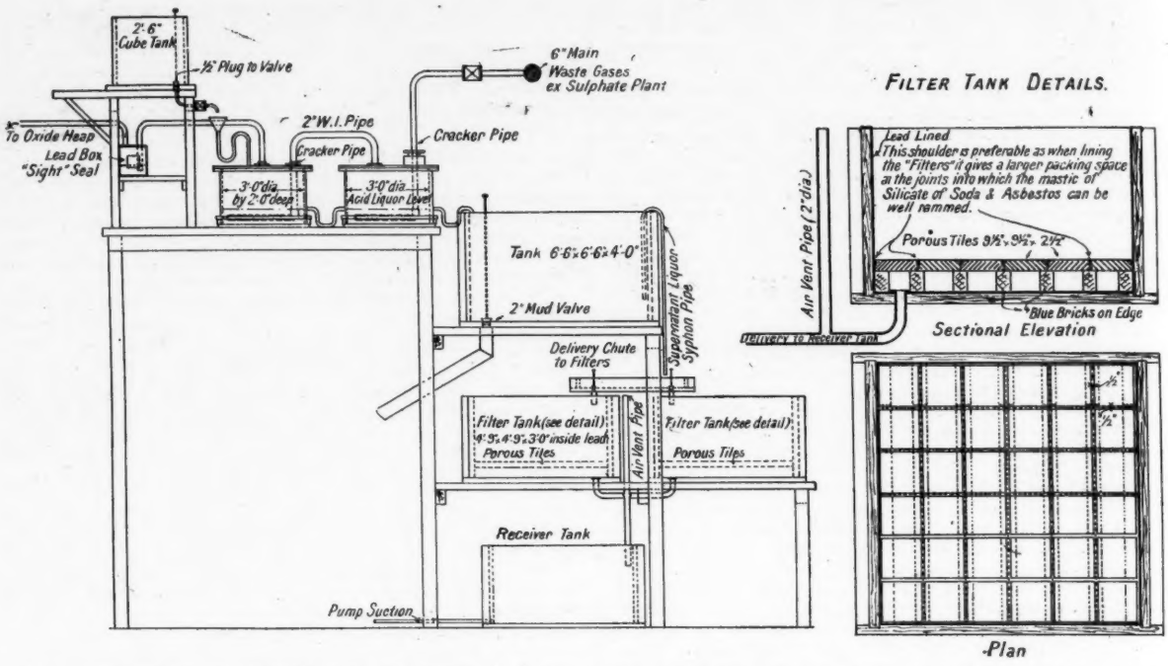

2'6" Cube Tank
½" Plug to Valve
6" Main
Waste Gases ex Sulphate Plant
2" W.I. Pipe
To Oxide Heap
Lead Box "Sight" Seal
Cracker Pipe
Cracker Pipe
3'0" dia. by 2'0" deep
3'0" dia. Acid Liquor Level
Tank 6'6"x6'6"x4'0"
2" Mud Valve
Supernatant Liquor Syphon Pipe
Delivery Chute to Filters
Filter Tank (see detail) 4'9"x4'9"x3'0" inside lead
Porous Tiles
Air Vent Pipe
Filter Tank (see detail)
Porous Tiles
Receiver Tank
Pump Suction
FILTER TANK DETAILS.
Lead Lined
This shoulder is preferable as when lining the "Filters" it gives a larger packing space at the joints into which the mastic of Silicate of Soda & Asbestos can be well rammed.
Porous Tiles 9"x4½"x2½"
Air Vent Pipe (2" dia.)
Delivery to Receiver Tank
Blue Bricks on Edge
Sectional Elevation
½"
½"
Plan

FIG. 2.—IMPROVISED DEARSENICATOR, TO TREAT ABOUT 5 TONS OF EIGHTY PER CENT. ARSENICAL ACID PER DIEM.

80 per cent. acid will be required [see Table II.]. But we will assume that 4·75 tons of 80 per cent. acid are actually employed. We will also assume that the content of arsenic in the $4\frac{3}{4}$ tons of 80 per cent. acid is 0·2 per cent.

It will be seen from Table III. that only 144·7 cubic feet of H_2S gas (or 361·7 cubic feet of waste gases) will be required to precipitate the arsenic as AS_4S_6 from the quantity of acid named. But, of course, 10 to 20 per cent. more than this volume will be required, as the acid must be completely saturated with H_2S.

The process of dearsenication will certainly be best carried out at a gas-works during the day. It will be assumed, therefore, that the $4\frac{3}{4}$ tons of 80 per cent. acid must be dealt with in a working day of ten hours.

It must be pointed out that it is highly inexpedient to dearsenicate 80 per cent. acid, as at this strength not only will free sulphur be deposited from the H_3S—which free sulphur is very difficult to separate—but the lead will be precipitated in a peculiar form, and the combined effect will be to impair materially the efficiency of the filters. Particularly is this the case if nitrogen oxides be present in the acid, as then the lead compound appears to assume a colloidal form, and will soon choke the pores of the filter tiles.

Acid at 110° to 112° Twaddel (*i.e.*, about 65 per cent. H SO_4) does not liberate free sulphur from H_2S; and this is undoubtedly the most suitable strength to use for dearsenication purposes. If, however, the acid is delivered to the gas-works at 70 to 80 per cent. strength, it must be diluted to 65 per cent. before being treated. The water for dilution can be added to the acid in the store tank; and the weak acid of suitable strength can be injected or pumped by an acid centrifugal pump to a small elevated feed-tank placed sufficiently high to gravitate into the washer or scrubber.

Fig. 2 shows full details of a dearsenication plant suitable for a works producing 5 tons of 25 per cent. sulphate of ammonia per day; and this plant may be taken as a well-proportioned one and must be increased or decreased *pro ratâ* to the make of sulphate above or below the 5 tons per diem named.

The Dearsenication Plant Recommended.

Perhaps a brief description of the dearsenication plant recommended, and the process of dearsenication, will be interesting.

The feed-tank is 2 ft. 6 in. cube inside the lead. It consists of a 2-inch redwood batten tank, braced with suitable tie-rods and lead lined with 7-lb. chemical sheet-lead. It is provided with a ½-inch plug and seat and ½-inch lead outlet pipe, to which a Regulus metal valve is attached so as to control the feed acid to the dearsenicator or washer.

The dearsenicator can be readily prepared by taking two 3-feet diameter flanged spigots, 2 feet in depth, and putting the spigot end into a cast-iron cap and running the joint with lead. These circular vessels are preferably lead-lined; the lead being turned over the top flange. There is, however, no need to lead-line the top plate, as no weak acid comes into contact with it—only the waste gases from the sulphate plant. For the purpose of lining the two dearsenicator vessels, 7-lb. chemical sheet-lead is quite strong enough. Indeed, if chemical plumbers are not readily available, the vessels would no doubt answer without the lead lining, as weak acid completely saturated with H_2S exerts very little, if indeed any, corrosive effect on cast iron.

It is for this reason that the well-known "Trepex" dearsenicator—one of the most efficient dearsenicators on the market for dealing with large quantities of acid—is made of cast iron. Although the makers claim that the cast iron they use is of special quality, I believe more depends on the fact that weak sulphuric acid saturated with H_2S is practically immune from action on cast iron, than on any merit which their particular quality of cast iron may possess.

The top cover of the first improvised dearsenicator vessel must have provision for 2-inch inlet and outlet gas pipes as also ½-inch sealed acid feed pipe, as illustrated. At the side, 8 inches from the bottom, there is a sealed acid outlet leading to vessel No. 2. The second vessel is provided with gas inlet and outlet pipes, and at the side with a sealed acid outlet leading to the settling tank. The gas inlet pipes in each case terminate with a horse-shoe cracker-pipe made of 2-inch bore chemical lead pipe, with a suitable number of ¼ inch diameter perforations similar to an ordinary cracker-pipe of a sulphate saturator.

The Principle of Working.

The principle on which the dearsenicator is worked is the countercurrent one; the acid flowing in contrary direction to the travel of the waste gases.

The cracker-pipe should be well sealed by the acid to be dearsenicated and of ample size. The waste-gas pipe, after leaving the coolers of the sulphate plant, should be bored and tapped, and a 2-inch wrought-iron pipe taken from it. This pipe should be provided with a 2-inch valve (pinion-and-rack type) for regulating the quantity of gases to the dearsenicator vessels.

The waste gases leaving a sulphate of ammonia saturator working under normal conditions have generally a pressure of 3 inches water-gauge; and this is a very suitable pressure at which to work the dearsenicator.

The unabsorbed gases leaving the No. 2 vessel are passed through the acid into No. 1, and then are led through an acid seal in a small leaden box provided with a glass sight—preferably to an oxide of iron heap, where the surplus amount of H_2S is absorbed.

Frequent tests should be made of the acid discharged from the dearsenicator, in order to assure oneself that the acid is satisfactorily impregnated with H_2S. The formation of sulphide of arsenic is a time-reaction; and it is therefore advisable to have settlers in which to admit of the precipitate in question coagulating and settling out. At least twenty-four hours should be allowed for this process.

The writer is aware of several dearsenicating plants designed without settlers—the acid being run direct from the dearsenicator into the filters. This is not advisable, in that the sulphide of arsenic settles to the bottom, chokes-up the filter tiles, and impedes the filtration very considerably. Indeed, some works that have installed plants without settlers have been compelled to use a small continuous feed of a light petroleum oil in the dearsenicator, in order to bring the sulphide of arsenic to the top of the filter tanks, and thus afford the clear subnatant acid to pass through the porous tiles at a reasonable rate. Such expedients, apart from being expensive, are not desirable; and it is wise to instal settlers to admit of the sulphide of arsenic congealing and settling, so that the supernatant acid can be syphoned-off each day to the filter tanks.

The Filter-Tanks.

As regards the filter tanks. These are made of 2-inch redwood battens, securely braced and lead lined with 7-lb. chemical sheet-lead. Some chemical engineers recommend filter tiles for the bottom and sides; others only for the bottom. The side tiles have certainly a tendency to collapse if not very carefully fixed; and, all things considered, the writer inclines to the belief that it is best simply to cover the bottom of the tank with the filter tiles.

There is some divergence of opinion as to the rate at which acid passes through the filter tiles. The makers declare that the acid runs through clear at the rate of 2 cwt. to 3 cwt. per square yard per hour with a head of 1 foot to 2 feet. Much, of course, depends on the cleanliness of the filter and the age of the slabs. A disintegrating action is bound to arise in time, and the pores of the slabs become choked, especially if no settlement is allowed.

It may safely be said that if the filter is clean, and the acid fairly warm, it runs through almost as fast as it runs in. If the acid is cooler, filtration is not so rapid. As the mud deposits on the tiles, the rate of filtration decreases, and it is necessary to remove the latter. From practical data of some experience, it would appear that from 12½ lbs. to 2½ lbs. of acid per square foot per hour may be taken as the rate of filtration, according to the condition of the filters.

It should be pointed out that if the filters are only provided with bottom tiles, the outlet pipe from such filters must be provided with an air-pipe run up the side of the tank flush with the top, as in the absence of this filtration is obviously impossible.

The sulphide of arsenic which accumulates in the bottom of the settlers must be washed periodically with water; and the washings should be utilized. If this is not done, loss of acid is inevitably entailed. On the other hand, if the mud is washed to recover the acid, unfortunately one dilutes still further one's dearsenicated acid. As a matter of fact, in the process of dearsenication, the strength of the acid is almost invariably reduced 5° or 6° Twaddel.

A Possible Difficulty.

This leads me to direct attention to another aspect—namely, the possible difficulty which may arise at many sulphate plants in dealing with acid of 105° to 106° Twaddel. In a well-designed and well-controlled sulphate works, it is possible to work with acid of 108° to 110° Twaddel without accumulating mother liquor; but whether this can be accomplished with 105° to 106° Twaddel acid is open to doubt. Obviously, gas-works or coke-ovens do not wish to resort to the concentration of sulphuric acid after dearsenication, if at all avoidable. Careful attention, however, must be given to this point. The filtered acid is collected in a lead-lined tank common to the two filters, and can be pumped or blown to the tank feeding the sulphate saturator.

Precautions.

The operation of dearsenication is not a difficult one—only care should be given to the treatment of the mud, in order to reduce possible loss of acid to a minimum, and the usual precautions observed with regard to H_2S, especially when cleaning the dearsenication vessels, or the settlers and filters. Many cases of asphyxiation by H S have occurred at acid works on the dearsenication section of the plant.

Waste of Sulphur.

One other question arises out of consideration of this subject. It does not concern a method for the production of good merchantable sulphate of ammonia from inferior acid, or even dearsenication of arsenical acid. It has reference to a much more vital matter—namely, our failure to take advantage of the available resources or means we have immediately at hand. It is estimated that approximately 12 million tons of coal are carbonized on bye-product coke-ovens per annum. The gas resulting from the carbonization of this coal will have a content of at least 450 grains of H_2S per 100 cubic feet; and the yield of gas may be taken at (say) 10,000 cubic feet per ton of coal carbonized. Only on very few coke-ovens is any attempt made to abstract the H_2S from the gas. At least 80 per cent. of the gas produced at the coke-ovens in this country goes forward to the ovens for reheating purposes or power purposes, untreated so far as regards the recovery of the H_2S.

When we are so obviously short of sulphurous materials for the manufacture of sulphuric acid as is unfortunately the case at the moment, one can better imagine than describe the profound feelings of gratification which will be evinced by acid manufacturers generally if it were suggested to them that an additional 51,620 tons of spent oxide of 50 per cent. sulphur content [see Table IV.] would be available per annum within the next six months.

Table IV.

100 cubic feet of coke-oven gas contain 450 grains H_2S. One ton of coal yields on distillation 10,000 cubic feet of gas.

Therefore: One ton of coal yields $\frac{450 \times 10{,}000}{100 \times 7{,}000} = 6{\cdot}4$ lbs. H_2S

Say 80 per cent. of the gas produced at coke-ovens is untreated for H_2S 80 per cent. $\times$ 12,000,000 = 9,600,000 tons.

$\frac{9{,}600{,}000 \times 6{\cdot}4}{2240}$ = 27,429 tons H_2S, or roughly 25,810 tons sulphur or 51,620 tons of spent oxide of 50 per cent. sulphur content.

We could contemplate the engineering of strikes at the Foldal mines in Norway by the Germans (a recent actual occurrence) with some degree of equanimity; but, unfortunately, to use a current expression, we are "too late again." It is hoped, however, that the Ministry of Munitions, who are in the best position to judge as to the inadequacy of supplies of sulphurous material at the moment, will have this matter brought prominently to their notice, and that they will consent to collaborate with the owners of coke-ovens and their managers and technical staff in order to recover such a valuable element and to avoid such apparent waste. From a national point of view, it is highly desirable that we should be independent of foreign supplies of sulphurous material. Yet here is a glaring case of our failure to take advantage of means which are immediately at hand of rendering ourselves partially self-supporting.

The Ministry of Munitions should also forbid (after reasonable notice has been given) the elimination of H_2S by means of lime, as also should they enforce the removal of compounds other than H_2S by the Carpenter and Evans process, in order that the sulphur may be recovered in a useful form.

If this article had not already assumed unusual length, it would be possible to demonstrate that the removal of H_2S from the gases arising in the distillation of coal at coke-ovens can be made a profitable undertaking. This aspect of the matter, however, must be thoroughly investigated by the coke-ovens technicians themselves.

In any case, this article will have served its purpose if it has been of assistance in indicating methods by which existing difficulties can be overcome, and increased usefulness will ensue if it serves to focus attention to the necessity of utilizing existing resources which, if taken advantage of, would relieve gas and coke-ovens managers of such problems as the best methods of dealing with arsenical sulphuric acid.

SIXTY YEARS AGO.

From the "Journal" for April, 1856.

Commercial Value of Gas Refuse.—Nothing, perhaps, is more remarkable in the history of gas lighting than the amazingly small advantage which this art has hitherto derived from the resources of practical chemistry. In the application of mechanics, and in the expositions of science, there have been, indeed, no lack of inventors and instructors; but, nevertheless, if we look anywhere in our gas establishments for the methodical employment of that routine of operations by which, in the chemical arts, a profit is drawn from mere waste refuse, we shall look in vain. In this respect, matters remain as they were in the earlier eras of Murdoch, Watt, Clegg, and Lowe. Then, as now, the only saleable products from a gas-works consisted of coke, gas, tar, and liquor. We will not enter into an analysis of the circumstances which may have retarded the development of this particular industry, though, no doubt, much of it has been due to the benumbing agency of what are called "patents," but which ought in reality to be called "pretensions." It is enough, however, that at the present moment there is nothing either of the one or the other kind which stands in the way of a gas company sincerely desirous of carrying the manufacture of gas out to that economical point at which the greatest profit is obtained at the least cost.

Burning in Effigy of a Gas Manager.—Bow Common Lane was the scene of an extraordinary incident on the evening of the 20th ult. A large body of workmen employed in a neighbouring gas-works assembled bearing an effigy, on the breast of which was inscribed a large cross, and on the head "The Tyrant of Bow Common Slaughter-House," to which a light was applied, amidst the yells and shoutings of the spectators. This unprecedented act is ascribed to the alleged tyrannical and overbearing conduct of a gas manager to the workmen employed under him, and has been commemorated by a printed card, extensively distributed among the persons employed in the Metropolitan gas-works. . . . The vicinity of the Great Central Gas-Works at Bow Common has been placarded with handbills, purporting to be signed by upwards of a hundred of the workmen employed in that establishment, and denying all connection with the outrage committed, which they allege was the act of three or four discharged workmen. In another handbill, subsequently circulated, it is asserted that some of the signatures were obtained under the threat of dismissal in case of refusal to sign the declaration.

Hansor's Olefiant Gas Company.—Some groundless apprehension has been felt lest the interests of gas companies might be prejudicially affected by the operations of a Company projected under the title of Hansor's Olefiant Gas Company, for carrying out Mr. Hansor's patent of March 24, 1854. The prospectus of the Company distinctly sets forth that no intention is entertained of entering into competition with coal gas; and when it is known that linseed oil-cake—a material inferior to Boghead cannel coal, and worth about £10 per ton—is that which can be used with most advantage in this country, all ground for apprehension disappears. The apparatus is unquestionably an improvement upon the original one of the Vegetable Gas Company, and may possibly be advantageously used in districts where coals are not accessible, and where oleaginous seeds, or the refuse from wine or olive presses, can be obtained at a cheap rate; but there are few localities in Great Britain where Mr. Hansor's system can be economically introduced.

WELDING OF HIGH-PRESSURE MAINS.

American Experience.

At the February meeting of the New England Association of Gas Engineers, Mr. A. S. HALL, the Superintendent of the Springfield (Mass.) Gas Company, read a paper on this subject.

He said: The welding of metals with oxygen and acetylene combined in the oxy-acetylene flame has been in vogue for only a few years; but despite this fact many gas engineers have taken kindly to the process, and have used it in welding their high-pressure mains and services. Many other gas engineers, who have not yet used this method, nor have even had much experience with high-pressure gas distribution, are now seriously considering the installation of high-pressure systems and the use of the oxy-acetylene process in welding high-pressure mains. It is the object of this paper to describe our high-pressure system at Springfield, and to explain our experience in welding high-pressure mains in such a manner that these latter gas engineers may be able to use the information as a basis for estimating the costs of their contemplated installations.

THE HIGH-PRESSURE SYSTEM.

In February, 1915, our high-pressure system consisted of 12·8 miles of threaded and coupled pipe in sizes ranging from ¾ inch up to 4 inches, and 14·6 miles of 4-inch universal pipe. A pressure of 40 lbs. per square inch was maintained throughout the system. Some of the mains were used as a direct high-pressure system with a governor on each service; while others were used to supply districts with low pressure, through district governors. One compressor plant was located at the gas-works. It consisted of one "Ingersoll-Rand" cross-compound duplex compressor, 11-inch by 18-inch by 10-inch and 16¼-inch by 10-inch, and one straight-line compressor, 12-inch by 18¼-inch by 12-inch.

In March, 1915, we had our first experience with welded high-pressure mains. It being necessary to renew about 2100 feet of worn-out 4-inch pipe, we decided to use some 6-inch double random length, plain end steel pipes, and try welded joints. Though the trial did not prove a great success, either in making tight joints or from a low-cost standpoint, we were satisfied that their difficulties could be overcome, and more satisfactory results obtained, with a little further practice.

At this time the Company had just received a franchise to supply with gas the town of South Hadley, together with Mount Holyoke College. To do this, we cut a 4-inch main into an existing 3-inch main at a point about ten miles from the Springfield works. From this point we ran about four miles of 4-inch main to South Hadley centre and about two miles of 4-inch main to connect side streets. We used 4-inch double random length pipe on the job; all the joints being welded. Valves were placed at intervals of 1000 feet. At the end of the main line at South Hadley centre we installed two steel storage tanks, each 50 feet long and 10 feet diameter, as a reservoir to maintain the normal street pressure during the peak load. Fig. 1 shows the method of connecting-up these tanks.

Mount Holyoke College was supplied with gas through a 4-inch branch line. On this line we installed a Reynolds 4-inch single district governor bye-passed by a 2-inch house governor. Though the college uses from 17,000 to 25,000 cubic feet of gas daily, the 2-inch house governor has adequately cared for the supply. We intend to maintain a pressure of 40 lbs. per square inch throughout this system.

COST DATA.

At this point some cost data may be of interest. It must be borne in mind that the welders on this job started as green men, recruited from the ranks of our regular street gangs. As soon as one man became proficient, another one was broken in, until we had six capable welders. Being inexperienced, they were slow at first in making joints, and lavish in the use of oxygen, acetylene, and filler metal. Some of the joints, too, leaked, so that they had to be rewelded. Our welders received $2·50 a day; their helpers, $2·25; and other labourers, $2. A total of 918 joints were welded on this job.

Cost of Laying Pressure Main.

	Dollars.
Pipe—31,976 feet at $0·2125	6794 90
Labour—digging and backfilling	4316·76
,, welding pipe	551·72
,, handling pipe	1482·03
Engineering	370·79
Trucking	195·58
Oxygen and acetylene	414·93
Filler metal	48·00
Valves—52 at $7	364·00
Fittings	308·51
Sundries	45·18
Total cost	14,892·40

The cost per foot worked out to $0·4657; and the cost per joint to $1·1052. The total cost of the compressor station was $4078·30—including the concrete foundations for, and the provision of, two steel storage tanks, a compressor, a 10 H.P. motor, the pipes and fittings, and the labour involved in the connections, wiring, and fixtures.

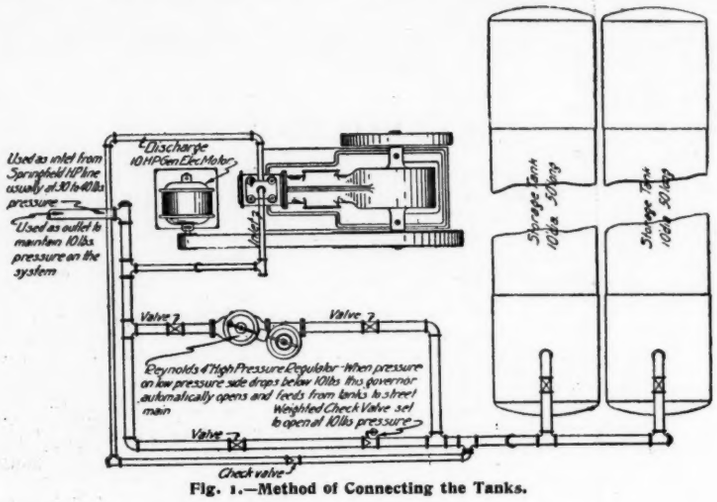

Used as inlet from Springfield HP line usually at 30 to 40 lbs pressure
Used as outlet to maintain 10 lbs pressure on the system
Discharge
10 HP Gen Elec Motor
Inlet
Storage Tank 10 ft dia 50 ft long
Storage Tank 10 ft dia 50 ft long
Valve
Valve
Reynolds 4" High Pressure Regulator—When pressure on low pressure side drops below 10 lbs this governor automatically opens and feeds from tanks to street main
Weighted Check Valve set to open at 10 lbs pressure
Valve
Check valve

Fig. 1.—Method of Connecting the Tanks.

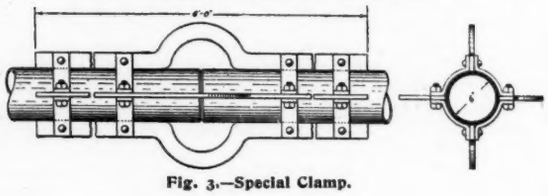


Fig. 3.—Special Clamp.

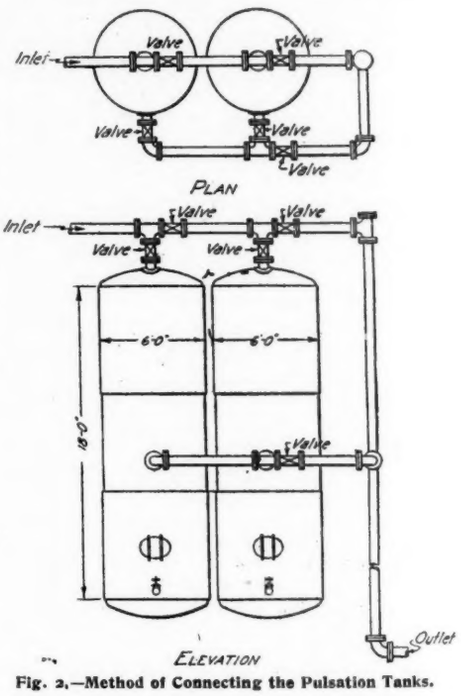


Fig. 2.—Method of Connecting the Pulsation Tanks.

Upon the completion of the 4-inch high-pressure main in South Hadley, we had but to glance at the figures to be firmly convinced that the welding of double-length pipe was the most economical method of laying high-pressure mains. Almost immediately we started another pressure job, larger than at South Hadley. This was to run a 6-inch high-pressure main starting at a point on the west bank of the Connecticut river directly opposite our works, and running thence through the towns of West Springfield and Agawam, a distance of 32,710 feet, to a point on the west bank of the Connecticut river, some five miles below our works. Here we crossed the river, a distance of 2100 feet, to a point on the east bank in the town of Longmeadow. From this point we ran southerly through the towns of Longmeadow and Thompsonville, a distance of 18,533 feet, and connected with the Northern Connecticut Light and Power Company's high-pressure system. We already had an 8-inch steel main, laid with Dresser river couplings, running under the river from our works to the West Springfield shore. It was from the west end of this 8-inch main that our new 6-inch main started.

PULSATION TANKS.

Just outside our compression plant at the works we installed two pulsation tanks. They were 6 feet in diameter and 18 feet in height—being placed in a vertical position. These tanks not only eliminate pulsation from the flow of gas, but they also act as

condensers, thereby immediately removing the bulk of the drip liquor from the line. Fig. 2 illustrates our method of connecting-up these pulsation tanks.

We connected our pulsation tanks directly to the already existing 8-inch river main. This main was laid in 1912, and was used as a low-pressure main. When we decided to use this 8-inch main for high pressure, we gave it an air-test at a pressure of 90 lbs. per square inch, and found a few leaks near the east shore. Further examination showed this section to be deeply pitted from the effects of electrolysis, due to stray currents from the street-railway system. Tests showed that the current flow varied from 5 to 6½ volts on the east shore, and from 6½ to 7 volts on the west shore—the tendency for current flow being toward the east shore in both cases. We renewed the pitted section of this main with single length, extra heavy steel pipe—all the joints being welded. In order to eliminate further trouble from electrolysis we installed two porcelain insulating joints in this line on each side of the river. Terminals were welded to the pipe between each pair of insulating joints, and run to manholes where frequent tests could be made. Tests showed that practically all current flow was eliminated. Our new 6-inch river main farther down the river was equipped with insulating joints in a similar manner.

The second river crossing was laid under contract, of which more will be said later. Directly after this second river crossing we ran through low meadow land for nearly a mile. Here we struck water and had our troubles. Before connecting to the Northern Connecticut Light and Power Company's system we ran our main through a small meter-house, in which we installed a 4-inch rotary high-pressure meter and a Foxboro orifice meter. Space was left in the meter-house for the installation of a Thomas electric meter and a Westcott meter in addition to those already installed. These meters are so connected that any meter or combination of meters can be run at a time. The meter-house is heated by a Holyoke tank heater, with the temperature controlled by a thermostat. This arrangement has given very satisfactory results.

The following cost data give the cost of laying this 6-inch main, not including the cost of laying the 2100 feet of main across the Connecticut river. A total of 1413 joints were welded on this job.

Cost of Laying Thompsonville 6-inch High-Pressure Main.

	Dollars.
Pipe (51,243 feet at $0·3810)	19,523·58
Labour—digging and backfilling	6,406 26
,, welding joints	1,005·49
,, handling pipe	2,544·18
Engineering	578·14
Trucking	1,226·45
Oxygen and acetylene	704·39
Filler metal	129·36
Valves (26 at $25; 4 at $7; 7 at $2·375)	694·63
Fittings	512·90
Sundries	139·64
Total cost	$33,465·02

The cost per foot worked out to $0·6530; and the cost per joint to $1·3016.

In granting permission to cross the Connecticut river with our main, the War Department specified that the pipe be placed at least 3 feet below the river bed. This necessitated the dredging of a ditch. For the sum of $3500 we contracted with the Springfield Navigation Company to do this work, which included dredging the ditch, handling and laying the pipe, and refilling the ditch—our welders doing the necessary welding and testing. A length of pipe was welded to the end of the main running down the west shore to the water's edge; the outer end of the pipe resting on a barge. A second length of pipe was then hoisted into position and clamped to the first length, thus preventing the pipes from getting out of alignment because of the motion of the boat. Fig. 3 shows this special clamp. After the joint was welded and tested, and found to be tight, the barge was moved ahead and the operation repeated until the river was crossed. As each joint had to be tested separately before being lowered into the ditch, the work necessarily progressed rather slowly. Five joints made a good day's work. A drip-pot made of a 7 ft. 6 in. length of 10-inch pipe, and with two connections to the main, was placed near each shore, where the drip-pot could be pumped if necessary.

Bevel to which Ends of Pipe are Cut.

In ordering plain-end pipe for a welded main, as described, an important feature which should not be overlooked is the bevel to which the ends of the pipe are cut. We have found from experience that the best angle for this bevel is 60° to the horizontal. It is absolutely necessary, in order to make a tight joint, that the inner edges of the two pipes be fused together before any filler metal is applied. There must be enough stock in the thin edges caused by the bevel to make this fusing possible. A bevel angle very much less than 60° to the horizontal does not give this necessary amount of stock; so that a hole is frequently burned, through which molten metal runs to the inside of the pipe. On the other hand, a bevel angle very much greater than 60° to the horizontal not only leaves the inner pipe edges too thick to be easily fused, but it does not leave enough room in the groove for a proper amount of filler metal.

We found it more economical to weld together and test long sections of pipe before placing them in the ditch. In order to keep ahead of a gang of forty men digging and backfilling, we had to work two welding gangs of three men each on the welding ahead, and another gang of two men connecting the long sections in the ditch, and making fittings. An average day's work for our welders was about sixteen joints each on 4-inch pipe and about eleven joints each on 6-inch pipe. If a welder can assume a comfortable position while welding he is more likely to do good work. He should sit on a small wooden bench with an arm resting on either knee—a position that can be maintained for some time before becoming tiresome. No welder should be allowed to light a torch without having on a proper pair of goggles.

At first we used chain-falls to lower the section into the ditch; but we soon found that 4-inch and 6-inch pipe could be lowered much more quickly by another method. Before the sections were lowered into the ditch, air was pumped into the pipe at a pressure of 90 lbs. per square inch. The joints were tested for leaks at this pressure by the soapsuds method. The pressure was maintained on the pipe until the section was lowered into the ditch, when the joints were again tested for leaks. We used a 20 H.P. Abenaque portable compressor to obtain our test pressure. As much care was taken in grading these high-pressure mains as with low-pressure mains—drip-pots being placed at all low points. Fig. 4 shows a typical drip-pot.

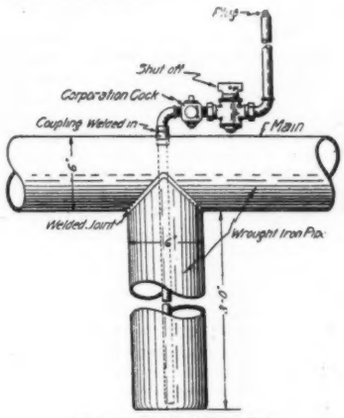


Fig. 4—Typical Drip Pot.

Taking Care of Expansion and Contraction.

It has been stated by some authorities on welded mains that expansion and contraction can be taken care of without expansion joints by simply "snaking" the pipe in the ditch. This may be good practice in some localities; but we do not recommend it in New England, where the temperature changes are so great. It is our practice to place an expansion joint at intervals of about 1000 feet. Although flanged valves are generally used in mains of this kind, we used extra heavy, semi-steel, screw-end valves with great success.

One of the great advantages of welded mains is the number and variety of bends and fittings which can be made on the job. All our drip-pots and tees, and most of our bends, were welded in this way. To facilitate this work, a number of sheet-metal patterns were prepared, similar to those used in making stove-pipe, to aid the welder in cutting the pipe properly. In some cases where sharp angled bends would have caused much friction we had special long radius bends made in the shop and then welded into the line.

Conclusion.

Before closing we would give one more argument in favour of welded high-pressure mains over threaded and coupled mains. In answer to a recent inquiry as to the relative cost of plain-end pipe and threaded and coupled pipe, we received the following data:

Size of Pipe.	Cost per Foot Threaded and Coupled Pipe.	Cost per Foot Plain End Pipe.
2-inch	$0·09	$0·085
4-inch	0·27	0·26
6-inch	0·48	0·46

Take the 6-inch pipe for example. By using plain end pipe a saving of $0·02 per foot or $0·80 per double length is made before the pipe leaves the mill. This goes a long way towards paying for a joint.

In closing, we can truly say we are thoroughly convinced that the laying of high-pressure mains with welded joints is the most economical method to date. We realize that this method is still in its infancy; but nevertheless we feel sure the time is near at hand when it will be in general use. In the light of our success during the past season, we are even considering the advisability of running low-pressure welded mains under certain conditions.

British Industries Fair, 1917.—The Board of Trade have now decided to hold the British Industries Fair in London next year from Monday, Feb. 26, to Friday, March 9, inclusive. Full particulars regarding the fair and the building in which it is to be held will be announced in due course. Having regard to the satisfactory results achieved by the two British Industries Fairs already held, the Board of Trade propose to organize the 1917 fair on similar lines. Participation in the fair will, therefore, be again confined to manufacturers.

BURNING AND DISTILLING WATER-GAS TAR.

In the course of a paper read on Feb. 16 before the New England Association of Gas Engineers, Mr. CHARLES OTTEN, JUN., the Superintendent of the Haverhill (Mass.) Gaslight Company, gave some account of his experiences in the burning under his boilers and the distilling of water-gas tar since Sept. 13, 1914—stating that after that date not a pound of coal has been used under the boilers, and no delay in the operation of the gas set has been caused by trouble with the fuel.

BURNING WATER-GAS TAR.

The boiler plant consists of two horizontal return tubular boilers, one of which is 72 inches diameter by 19 ft. 6 in. long, and has 92 tubes 3½ inches diameter and 18 feet long. This is known as "No. 1" boiler. The other boiler is 78 inches diameter by 21 ft. 6 in. long, and has 120 tubes 3½ inches diameter by 20 feet long. It is known as "No. 2." Both boilers have overhanging fronts.

The tar-burners used are known as "Best's No. 2;" and each boiler is equipped with one burner, placed in the centre of the front of the boiler-setting, and pointing straight back; being inserted through a piece of 5-inch cast-iron pipe placed in the front wall. No. 1 boiler was the first to be equipped. The grate was left in position and chequer-bricks were laid over the top; and the bridge-wall was cut down to about the level of the chequer-brick on the grate. The burner was placed at such a height that the nozzle opening was 8 inches above the chequer-brick; and the nozzle projects 2 inches inside the front wall of the setting.

The tank for supplying the burner is 47 inches diameter by 7 ft. 6 in. long. It was placed in the coal-shed just above the tar-pump, and at a height of 15 feet above the floor of the boiler-room. An overflow pipe was carried from the top of the tank to a drip funnel, placed alongside the tar-pump. The tank is filled until tar overflows into the funnel. This overflow has a vent near the connection to the tank; and the bottom should be sealed in a pot. The vent pipe is carried up about 4 feet, and has copper gauze in the opening to the atmosphere. The pipe line to the tar-burners is 1¼-inch, and was connected to the bottom of the tank. It supplies the tar into a 2-inch pipe, which was run in front of the boilers, about 2 inches above the boiler-room floor, and connection was made to each burner from this 2-inch line. This connection is 1-inch; and just below the burner was installed a ¾-inch regulating cock for controlling the quantity of tar. A ¼-inch pipe was run through the 2-inch tar-line, and connected to a steam-line, so that the tar could be heated when necessary.

As no coal was to be used in the boiler, and it would be necessary to shut off the tar-burner from time to time, a lighter was installed which has proved very satisfactory.

A gas line was carried along the front of the boilers and an outlet left near each of the tar-burners. A piece of ¼-inch pipe was connected to the outlet with a piece of metal tubing. When the tar-burner is to be lighted, and the brickwork is too cool to ignite the tar, the gas-burner is lighted and placed through the burner opening so that the gas-flame is alongside the tar-burner nozzle. The steam and tar are then turned on, and the burner will light very quietly. The gas-flame is then extinguished, and the torch withdrawn as soon as the brickwork is heated sufficiently to keep the tar ignited.

OPERATION.

One boiler is worked at a time; and as the gas set is not operated the full 24 hours every day, the boiler is not under full load the entire time. When the load is small, the tar-burner is shut off, and all the doors tightly closed until the steam pressure drops, as this was found safer than trying to cut-down the tar to the burner. When the latter method is used, there is danger of the flame being extinguished; and then, when it is re-lighted, there will be a puff of flame through the air openings, caused by the lighting of the tar that has flowed while the burner is out. With the gas-torch described, it is no trouble to light the burner. In adjusting the burner, the fireman uses as little steam as possible, and opens the ash-pit doors just enough to prevent any smoke appearing at the stack.

Results of Boiler Tests.

	Dec. 15, 1914	Jan. 8, 1915
Date of trial		
Duration of trial . . . . . hours	8·02	7·72
Steam pressure by gauge . . . . lbs.	111·9	111·8
Draught in ash-pit under opening in chequer-brick left for air . . . . inches of water	0·06	0·05
Temperature of external air . degs. Fahr.	22	41
,, of boiler-room . ,,	52	66
,, of feed water . ,,	170·5	180·0
,, of escaping gases from boiler degs. Fahr.	405	373
Weight of tar as fired . . . . . lbs.	3,075	3,092
Water in tar . . . . . per cent.	0·5	0·4
Weight of tar free from water . . . lbs.	3,056	3,080
Calorific value by Emerson bomb per lb. of tar used	17,205	17,270
Total weight of water fed to boiler . lbs.	37,842	38,494
Equivalent water evaporated into dry steam from and at 212° . . . . . lbs.	39,300	40,200
Horse power developed (on 34½ lbs. basis) .	142	151
Rated horse power of boilers	150	200
Percentage of rated horse power developed .	94·5	75·5
Efficiency of the boiler* . . . . per cent.	72·2	72·9
Cost of fuel used for evaporating 1000 lbs. of water from and at 212° . . . . cents	17·5	17·3

* Heat absorbed per pound of tar free from water divided by the heat value of 1 lb. of tar free from water.

A test was conducted on this boiler with the above arrangement on Dec. 15, 1914; and the principal results are given in the table. The next test was run on Jan. 8, 1915, and the arrangement of the air-spacings, &c., are given in fig. 2. It will be seen that some air was admitted through openings in the brickwork placed in the fire-doors; also that the distance between the grate and the boiler shell is greater than in boiler No. 1. The results obtained from the boilers are much different from each other.

MAINTENANCE.

The brickwork of the boiler-settings has required no repairs beyond a little pointing-up when the boilers were shut-down. No repairs have been needed on the tubes or shell; and there is no noticeable wear. From Sept. 13, 1914, to Jan. 25, 1916, No. 1 boiler was in operation 314 days, and No. 2, 186 days. Every morning the fireman blows steam through the boiler-tubes; and once each week the tubes are cleaned with a wire-brush.

OPERATING COSTS.

When coal was burned, it was necessary for a helper to wheel the coal from the shed to the boiler-room; and the cost of this work during 1913 was $340, and for the first eight months of 1914 $200. No help is now required for the fireman; and he is able to do many jobs that can be taken to the boiler-room, at the same time giving careful attention to the boiler. The tar-supply tank is filled in a few minutes by either the fireman or the engineer. Not having any coal or ashes to handle, the boiler-room can be kept clean with a much smaller expenditure of labour.

From Oct. 1, 1913, to Aug. 31, 1914, the following quantities of coal were burned under the boilers:

1,522,000 lbs. bituminous coal.
109,000 ,, generator coal screenings.
393,000 ,, coke screenings.
828,000 ,, anthracite screenings (bought locally).

The book value of these fuels was $5390, or 1·96 c. per 1000 cubic feet of gas made (275,468,000 cubic feet).

From Oct. 1, 1914, to Aug. 31, 1915, the quantity of tar used as boiler fuel was 246,781 gallons, charged to the boiler fuel account at 2 c. a gallon—a total cost for the eleven months of $4935, or 1·72 c. per 1000 cubic feet of gas made.

The writer realizes that the quantity of gas made is not the best divisor for making a comparison of costs; but there were no means of determining the amount of water evaporated during the periods. The generator coal screenings and coke screenings were charged to the boiler-fuel account at the price paid for broken coal and coke respectively.

The steam for heating the storage holders is not supplied by these boilers, and the coal for the boilers at the holder stations is not included in the costs.

DISTILLATION OF WATER-GAS TAR.

Distillation tests of the tar on hand indicated that some of the light oils could be distilled-off in a steam-heated still. At the price quoted for this material, it was seen that the removal of these oils would be profitable.

The still was an old tank, 36 inches in diameter by 17 feet in length, with a coil of 1725 feet of ¾-inch black pipe in lengths of about 16 feet. A steam connection was made to the top of the coil, and the exhaust carried from the bottom. A valve was placed on the steam inlet, just before the still, and a pressure gauge between the valve and the still. The exhaust valve was kept open just enough to allow the water to drain off. The end of this exhaust line has a cap drilled with a 3/16-inch hole; and the water runs into a funnel on a drain pipe. The still was covered with asbestos cement about 2 inches thick. There are two 2-inch connections on the top of the still for carrying off the vapour, and two draw-offs at the bottom for the residue. There is a line from the draw-off to the tar-pump and to the bottom of the relief holder tank as well as to two small storage tanks.

The vapour outlet leads to a condenser alongside the still, and then to the collecting tanks. This condenser was an old one—28 feet by 7 inches, and with twenty-six tubes 1¾ inches diameter, through which the vapour passes; the water being around the tubes. In warm weather the condenser was not of sufficient size to condense all the vapours; and another condenser consisting of eight full lengths of 1-inch pipe, through which the products from the still pass, was installed quite near the collecting tanks. Directly above the top pipe of the condenser was a ¾-inch pipe, drilled along the top for the entire length with ¼-inch holes about ¼-inch apart. A water-line was connected to one end of this drilled pipe; and a small amount of water was allowed to trickle

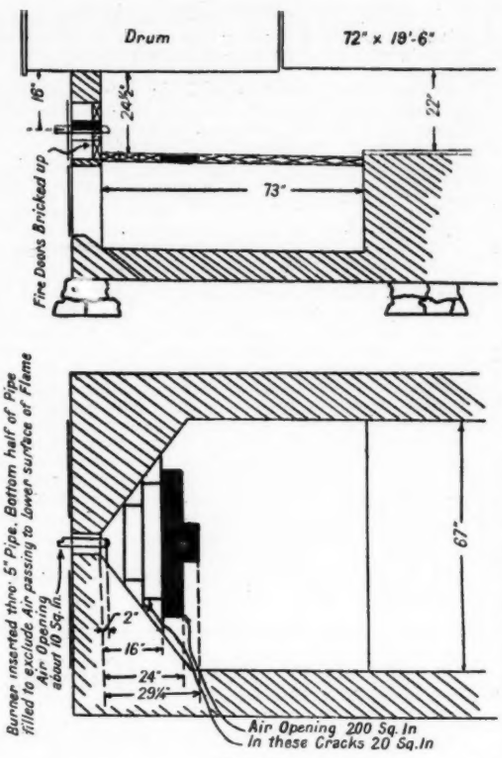


Fig. 1.

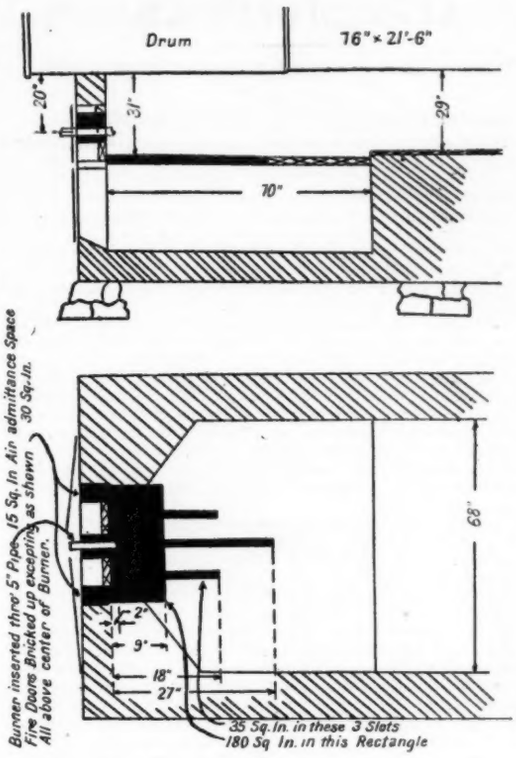


Fig. 2.

The Black Spaces show Air-Openings in the Bricks.

through the holes and run down over the condenser pipes. To cause the water to run from one pipe to another, and to keep it from running off the pipes before it reaches the lowest one, some burlap was hung over the pipes. The condenser uses very little water, and no vapour escapes. When it was put into commission, the use of water in the old condenser was discontinued.

The oil is stored in an old 10,000 gallon tank; and as this tank was not low enough for the oil to run directly into it from the condenser, two collecting tanks were set up alongside each other, and a pipe connection made from one to the other near the top. The oil and water from the still ran into the first tank, which is 3 feet by 7 feet; and the water settles out, and is withdrawn from time to time through a draw-off on the bottom. When the tank becomes filled to the height of the connection to the second tank, the oil runs over into that tank (3 feet by 4 feet), and is drawn off and moved to the storage tank. In this way, very little water gets to the storage tank.

Operation.

The tar for the still is taken from the relief holder tank, about 3 feet or 4 feet from the bottom, through a suction pipe run to the bottom tank and then up inside the holder. The still is filled to within about 7 inches of the top and steam turned on the coil. A definite steam pressure is maintained in the coil—changed from time to time, so that when samples of the distillate are tested in the laboratory, from 15 to 20 per cent. will distill over at 135° C. Usually, the steam pressure is between 40 and 60 lbs.

During the greater part of the time the still has been in operation, the charge was allowed to remain in the still for twenty-four hours. If no oil was coming over, the charge would be taken out sooner. When the residue was drawn off the still, the two small tanks for tar (holding about 300 gallons each) were filled, and the balance run back to the bottom of the relief-holder tank. The tar in the 300-gallon tanks was then used for boiler fuel or sold. By returning the excess tar from the still to the holder tank, it was possible to operate the still continuously, and thereby obtain the maximum amount of oil for sale. No other tank was available for storing this refined tar.

Results and Costs.

The still was put in operation on June 1, 1915, and up to Dec. 31 there was obtained 23,400 gallons of oil. The percentage taken out of the tar in the still varied between 6 and 10 per cent.

The value of the distillate, after deducting the original book value of 2 c. per gallon for tar, amounted to		$846·00
Cost of labour operating still, handling oil, &c., was	$99·00	
Cost of water for condenser	47·00	
Cost of miscellaneous items (thermometer for tests and pump parts)	16·00	
		162·00
Balance		$684·00

The cost of the apparatus installed, not including the small tanks or the storage tank, was $260.

Interest for seven months, at 6 per cent. is	$9·10
Depreciation at 15 per cent. per annum is	22·75
Total	$31·85

No charge was made for the steam used, although tests show that the condensation from the coil in the still was 2300 lbs per 650 gallons of tar distilled.

The refined tar from the still flows freely to the burner, and the calorific value of the samples tested was 17,260 B.Th.U. per pound. This residue is free from water. Tests of samples of tar from the relief holder, before going to the still, showed the water content to be ½ per cent. Samples of distillate tested in an Emerson bomb calorimeter show a calorific value of 17,800 B.Th.U. per pound. No other analysis of the distillate has been made.

Output of Coal in the Past Year.

Preliminary figures as to the output of coal in the United Kingdom last year are contained in a White Paper issued a few days ago, showing the estimated quantities of coal raised in each quarter of 1915, compared with particulars for the corresponding periods of 1914. From this, it appears that the quantity of coal raised last year was 253,188,000 tons, as against 265,643,000 tons in 1914. Thus 1915 shows a falling off of 12,455,000 tons, or 4·7 per cent. In connection with this figure, however, it is shown that the mean percentage reduction in the number of persons employed in the four quarters of the year, based upon returns furnished to the Coal Mining Organization Committee, was 12·2. Of the output of 253,188,000 tons last year (which includes coal used for colliery purposes), 46,321,000 tons—including the coal equivalent of coke and manufactured fuel—were exported, leaving 206,867,000 tons available for home consumption, of which 13,631,000 tons were shipped for the use of steamers (excluding those taken up by the Admiralty) engaged in foreign trade. In 1914, with the exports at 62,458,000 tons, there remained 203,185,000 tons available for consumption; and in 1913, when the exports were 77,307,000 tons, there remained, of a total output of 287,412,000 tons, a balance of 210,105,000 tons similarly available.

The Executive Committee of the City and Guilds of London Institute have appointed Professor Gilbert T. Morgan, D.Sc., F.R.S., of the Royal College of Science, Dublin, to the Chair of Chemistry of the Institute's Technical College, Finsbury, rendered vacant by the death of Professor Meldola. Professor Morgan was a former student at the College under Professor Meldola, and was later for some years Chemist in the works of Messrs. Read Holliday and Sons. He is a recognized authority on synthetic chemistry and dye-stuffs, on which subjects he has published many original papers. He will take up his duties at the College after Easter.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Central Organization—A Chapter of History.

SIR,—The inspiring article in your current issue will have caused quite a flutter in many a circle, which, if only it leads to unity of action, will be more than justified. That the gas industry is about to be awakened from its long sleep by such an important matter as the organization of forces which at present are largely frittered away, is indeed refreshing.

Apart from the reduction of power involved in the existing system, or absence of system, is that there is often overlapping of interests. These are, in many instances, so involved as to be well-nigh inseparable without injury to the object concerned.

One is unable to comment upon the scheme about to be propounded, for want of any information thereupon; but in due course this disability will be abolished.

A genuine central representative organization has been urgently needed for years, but has now become an absolute necessity. While it would have been well if a National Gas Institute had been available, that is not of itself a necessity for concentration of strength. If the latter is assured, then the former will inevitably follow.

This is not a time to dwell upon the differences of opinion which have hitherto prevailed. In face of the larger interests concerned, all smaller ones must be abolished.

As you indicate, "there is no truly representative body that can speak and act for the whole of the interests involved," during the present crisis in history. This deficiency is apparently to be changed and a larger idea to take its place.

One awaits with eagerness the proposed issue, and as "hope springs eternal in the human breast," all will earnestly desire a wise and broad basis for a central representative organization. Doubtless numbers of your readers would like to deal with so interesting and important a topic as the one raised by your article, but will restrain themselves from criticizing an abstract idea when, as you suggest, the practical is so soon to be in evidence.

My dream has always been for a "Central Organization," coupled with a "National Gas Institute;" and it would appear that, like other dreams, it is likely to come true. At all events, the vision is there; and as one of the proverbs of Solomon affirms, "where there is no vision, the people perish." The gas industry is not going to perish; the visions have not been hopeless; and at last the day dawns.

Having regard to what is "in the air," it would appear advisable for the suggestion of a "Central Technical Gas Research Association" to remain in abeyance—Mr. Thomas Glover's able remarks thereon notwithstanding. It is just possible though that he, in conjunction with your readers, had not any knowledge of the business in hand which must take precedence over all others.

EDWARD A. HARMAN.

15, *New Street, Huddersfield, April* 13, 1916.

[A further reference to the subject of "Central Organization" appears in the editorial columns to-day. Among the private communications received on the subject, is one in which the writer, speaking of the benefit of a representative Gas Association for matters of general and mutual interest, says: "Strong as may have been the need for considered policy five years ago, the claim is irresistible to-day, and with competition now substituted for monopoly, delay will prove irremediable."—ED. J.G.L.]

The Gas Industry and Foreign Competition

SIR,—When, in the discussion on Mr. Thornton's address, I said that the question of foreign competition "was not a matter *directly vital* to gas undertakings," I used words in their exact meaning. Gas undertakings have no foreign competition to contend with in respect of their primary business—the sale of gas. I agree with Mr. Glover that there are questions connected with international trading which are "of direct interest" to the gas industry; but that is a very different matter from being "directly vital."

F. W. GOODENOUGH.

47, *Victoria Street, S.W., April* 13, 1916.

Common Action in the Commercial Market.

SIR,—Your leader of the 11th inst., and the following article, "Residual Products Restrictive Clause," induce the reflection that the fundamental difference between the policies of the gas industry and its chemical and colliery "friends" is that the latter combine, *inter se*, effectually to protect their financial and trade interests while the former does not.

It may be well to imitate our would-be tutelary "friends" by trying to make Parliament subserve our policy and interest; but it would certainly be better first to follow their preliminary example by uniting to take common action in the commercial market.

The Gas Coal Association and the Tar Distillers Association take steps that are far more effective in promoting the interests of their members, when it is a question of contracts, than anything that Parliament may do.

If the gas industry would organize in like manner to serve its commercial ends, parliamentary action might be regarded with more complacency than of late. Short of combined buying, there appears to be no effective way of dealing with the coal "ring;" but the tar "ring" could be broken by means of co-operative district associations or companies financed by means of gas companies' reserve and surplus funds. It is quite feasible to do this under the existing law.

The situation in respect to both commodities can be dealt with without appealing to Parliament, or any other outside body, for help, if only the gas industry has the "will" to do it.

SODALIS.

April 12, 1916.

French Pipe-Foundries.

SIR,—I see in this week's "JOURNAL" a paragraph relative to the above, in which a quotation is made from my letter published in January.

This quotation is rather misleading, as it omits a very important qualification; and I think it is only fair that the omission of the words "unless and until these and other French pipe-foundries are released from German control," should receive some notice.

Having no interest whatever in English pipe-foundries, I was particularly anxious to avoid any criticism on French pipe-foundries which were not dominated by German capitalists.

ANTI-GERMANICUS.

April 12, 1916.

Heat-Resisting Glassware.

SIR,—We noted in your issue of April 4 the report of the discussion at the Illuminating Engineering Society, when different makes of heat-resisting glass were mentioned—viz., "Jena," "Resisto," and "Monopel"—of German and Austrian origin. But we did not notice any reference to the French heat-resisting glass, "Silchrome" brand, which we introduced into this country with great success in 1901.

It is very regrettable that, at the moment, on account of the shortage of material and labour in France, large quantities are for the present out of the question. But we hope that, after the war, this glass will be a very formidable competitor against the German and Austrian makes, in combination with the help of the Institute of Chemistry and the National Physical Laboratory, which will enable the English manufacturers to produce a good heat-resisting glassware so that, once and for all, we do not have to rely upon the enemy production.

WHOLESALE FITTINGS COMPANY, LIMITED,
per F. C. BARNETT.

23-27, *Commercial Street, E., April* 12, 1916.

LEGAL INTELLIGENCE.

LIGHTING REGULATION PROCEEDINGS.

At Aylesbury on Saturday, Mr. Arthur G. Lane, Assistant Manager to the Gas Company, was fined £50 for not reducing lights at the gas-works in the early morning of the 3rd inst. A special constable stated that he was in the tower of the parish church when he saw "a brilliant light like a stationary searchlight" illuminating a large area. Defendant, who pleaded guilty, explained that the light came from the ventilators of the retort-house, which had now been screened.

At the Lewes Petty Sessions, last Tuesday, Mr. Edward Jones, the Manager of the gas-works, was summoned for failing, on the 31st ult., to cover or obscure the roof areas and windows of the works so that the lighting intensity was reduced to the minimum necessary for the safe and expeditious progress of work. A police sergeant stated that he went to the works. Before he reached them, he noticed a light proceeding from the top part of the building; and when he got into the yard, he saw a light showing from a small window and seen across the yard. He went into the retort-house, and saw seven gas-burners alight. They had been turned-down to about a quarter of their full power. At the top of the building, there was an opening in the roof; and this was where the light was shining through. At his request, the foreman turned four of the lights out. Later he saw Mr. Jones, who said he accepted responsibility for the lights. He said the top of the building had been damaged by the gales, and was being repaired as soon as possible. Subsequently a tarpaulin was placed over the hole in the roof. Defendant said about 27 feet of the top of the building was blown down on March 28. They commenced repairing the damage at once; but this necessitated the erection of a considerable amount of scaffolding, as the damage was so high up. With regard to the light showing in the yard, the window was very small; and the gas-jet was some distance from it. It was the only light to illuminate the yard, which was used during the night by the workmen for depositing clinkers, &c., from the works. Every endeavour had been made to comply with the regulations. The lights were reduced as much as possible—so much, in fact, that on several occasions the workmen had complained that they were not sufficient for their safety. The Bench considered that defendant had taken all reasonable precautions to comply with the regulations; and the summons was dismissed, on payment of 4s. costs.

The Assistant Engineer at an electric power station near the north-east coast, was summoned for not turning off the lights in the boiler-house, which had a glass panel in the roof, on the night of a raid. It was stated that defendant, though warned, did not switch-off the lights until bombs were dropped some miles away. Ten minutes later two bombs were dropped. For the defence it was urged that the glass in the roof was painted over, and that defendant had failed to appreciate his duty until the bombs were dropped. He admitted his error, and deeply regretted it; but there was no wilful or felonious intent. He was losing his situation in consequence. A fine of £10 and £3 expenses was imposed.

Nottingham's Diminished Lighting.—It had been thought by most residents in Nottingham that the limit had been reached in regard to the curtailment of street illumination; but on grounds dictated by economy, and safety in the event of air-raids, a further diminution of public lighting has been decided upon. None of the street-lamps, except at important crossings in the centre of the city, are to be lighted during the summer months. This will render it possible to dispense with the services of many lamplighters; and for some of these, who have been employed by the Corporation for quite a long number of years, it is understood work may be found in other directions.

REGISTER OF PATENTS.

Controlling the Rate of Discharge of Liquids.

PATERSON, W., of Norfolk Street, Strand, W.C.

No. 3069; Feb. 25, 1915.

This invention, relating to apparatus for controlling the rate of discharge of liquids, is particularly (though not solely) applicable to the control of the rate of discharge from gravity or pressure filters; the invention being capable of general application in all cases where the rate of discharge of a liquid is to be maintained uniform, or uniform within very narrow limits.

The patentee claims the use of a float operated by changes in the level of a body of liquid—such that for the minutest variations in the level of liquid above the discharge weir or in the pressure on a submerged discharge orifice or on the Venturi head, a relatively large movement of the level of the liquid controlling the float is obtained with correspondingly considerable movement of the float and of the discharge controlling member regulated thereby. The apparatus comprises a float operating device for regulating the valve; this device being arranged in a chamber into which a portion of the discharge overflows, and is balanced at the normal rate of discharge by an outflow through an outlet orifice in the float chamber substantially as described. Means are provided for varying the predetermined rate of discharge as may be desired, as also for controlling the rate of discharge by altering the size of the outlet orifice in the float chamber and/or the rate of fractional inflow into the float chamber. There is also an arrangement to secure the float to the valve in order to vary the area of the escape orifice according to the level of the liquid above it.

Connecting Branch Pipes to a Main Pipe.

USSHER, L., and HALL, A., of Johannesburg.

No. 100,164. Application dated March 16, 1915.

This invention is a modification of that described in patent No. 8360 of 1887 so as: (*a*) To produce a device of the kind at very small cost; (*b*) to produce the device in a more portable form; (*c*) to so form the connecting means as to enable more than one branch pipe to be secured to a main pipe by the aid of one connecting device; and (*d*) to produce a device which shall be compact in use and be more or less flexible.

Fig. 1.

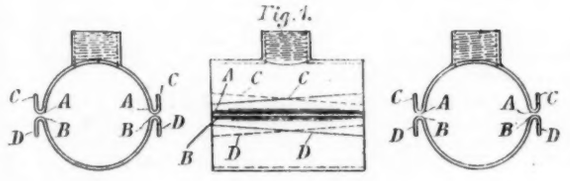
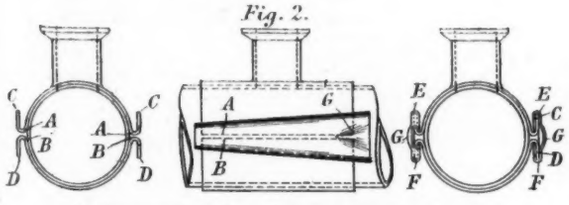


Fig. 2.



Ussher and Hall's Branch Pipe to Main Connector.

Fig. 1 is an elevation and two end views of an ordinary screw-threaded branch-pipe connecting-piece and the fastening clips hereafter referred to. Fig. 2 is an elevation (with end views) of the coupling with the branch pipe connecting piece provided with a flange in lieu of a screw-threaded branch connecting piece.

The ring or band shown is composed of two segments only, formed of stout sheet metal, each being so bent that when brought together they correspond approximately in diameter with the external diameter of the main pipe. The segments are provided with branch pipe connecting pieces brazed or welded to the segment when formed of sheet metal. The two ends of each segment are bent through a straight line, as at A B, outwardly and downwardly towards the exterior of the segments; and the free edges of the bent portions are formed diagonally, as shown at C D, so that when the segments are assembled to form the ring they will be parallel to each other, and each pair of bent ends will describe a keystone shape as shown.

The segments of the ring are drawn together on to the pipe by a clip (made of sheet metal), formed keystone shape, having channels E F at two of the side edges to engage the keystone parts of the segments by sliding thereon.

The method of applying the invention is to perforate the pipe with which the branch connection is desired and surround the perforation with packing material. The segments carrying the branch pipe connecting pieces are placed on to the pipe—the perforations therein respectively registering with the bore of the branch pipe connecting pieces; the segments being brought together by engaging the clips with the keystone part of the segments and driving the former home on to the segments as shown in fig. 2.

To facilitate the removal of the clips from the segments when desired a portion of the clip may project outwardly at its wider end (as at G) to receive blows from a hammer.

Introducing Gases into Intimate Contact with Liquids.

MOTTRAM, G. W., of Deepcar, near Sheffield.

No. 4240; March 18, 1915.

This invention relates to means for introducing gases into intimate contact with liquids; and while particularly applicable for employment in sewage purification, is equally serviceable in the treatment of other liquids requiring the introduction of gases thereto. It has reference to the construction of tubes, tiles, and blocks of a porous character through which the gases are forced to, and in contact with, the liquid.

Hitherto, the patentee remarks, these devices have been made-up of porous materials, of substantially the same size of grain throughout, or, where not of equal size, the various-sized grains have been intermixed in irregular order throughout the mass. Consequently, the gases passed through them have been in greater volume at one point than at another, "so defeating the really essential object of the devices, which is to effect as great and regular a breaking-up of the gases throughout the devices as is possible in order that their diffusion in the liquid may be completely effective." He therefore makes the main body of the tube, tile, or block of coarse particles of material of substantially regular size; and in combination with the body material there is employed a facing or exuding surface made up of the same material as the body but of finer grain—the body and facing being moulded against each other, and of one-sixth to one-fourth the thickness of the body.

Impregnating Fibrous Materials with Zirconium Compounds.

MOND, A.; a communication from E. RIETZ, of San Paulo, Brazil.

No. 4457; March 22, 1915.

This invention relates to a process for impregnating fibrous materials for textile purposes with zirconium compounds, "by which process it is possible to incorporate considerable quantities of the latter with the fibre in a durable and stable form."

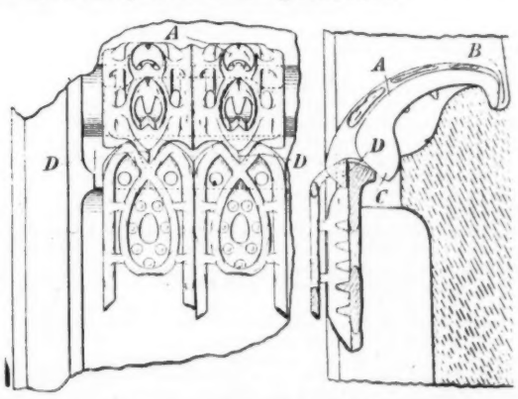
In order that the invention may be readily understood, the patentee refers to methods hitherto in use for impregnating fibrous materials with zirconium compounds. He says: "In the manufacture of incandescent bodies for lighting and heating, zirconium compounds are sometimes used in conjunction with other rare earths. For preparing such bodies a hood or mantle of fibrous material is soaked in a solution of a zirconium salt. An admixture of various neutral salts is sometimes used in addition to the zirconium salt—for instance, calcium and ammonium nitrates may be added to the zirconium salt solution for the purpose of ensuring complete combustion of the fibrous material, or for producing greater stability of the incinerated mantle, or for imparting a certain coloration to the flame. On burning the fibre a skeleton of the rare earths remains." He adds: "The object of the present invention is to cause precipitation of an insoluble zirconium compound not only upon, but also within, the fibre. This object is attained by causing a precipitate of the hydrogel of zirconium hydroxide to be formed within the fibres of the textile materials." And he then gives two typical examples for carrying out the process.

Securing Gas-Fire Radiants.

PARKINSON STOVE COMPANY, LIMITED, and CHESHIRE, W., of Birmingham.

No. 11,761; Aug. 14, 1915.

The device for holding gas-fire radiants of the columnar type in position is intended to admit of their being readily detached or replaced when required, as also to separate the fuel from the back of the grate, and "leave an air-space for facilitating combustion."



Cheshire's (Parkinson Stove Company) Gas-Fire Radiant Holder.

The illustration shows a front elevation of the device in engagement with the top of the fuel; also a side elevation showing how the fuel is held in place.

The fire-clay fuel holder A is of a "skeleton claw-like" construction. Its rear edge has projections on its underside arranged to fit within a longitudinal groove B in the top of the fire-brick back of the grate—the groove being just above the top of the radiants. Near the opposite edge of the holder are a pair of separated depending lugs or projections C forming distance-pieces, arranged to come behind the radiants so as to separate them from the back of the grate. The top of the fuel holder is perforated with a number of holes "to allow of

the passage of a free current of air and also to allow of the more readily escape of the burnt gases." At the front edge of the holder are a further pair of depending lugs or projections D, arranged to come between the distance-pieces and adapted to engage within the open upper ends of the radiants, so as to hold them in place in an upright position. By raising or tilting the front part of the fuel holder, the radiants can be removed and replaced as required.

Gas-Engines.

ROGERS, F. H.; a communication from L. E. & O. Simpson, of Cincinnati, Ohio, U.S.A.

Nos. 5587-8; April 13, 1915.

The inventors claim for the first patent: Improved valve mechanism for four-cycle internal combustion engines comprising a secondary cylinder arranged above the primary or main cylinder, and communicating with it through the medium of the combustion chamber, provided with inlet and outlet ports; a hollow secondary piston working in direct contact with the wall of the secondary cylinder, and having ports through it co-operating directly with the ports in the secondary cylinder; a tertiary piston disposed within, and working in direct contact with, the inner wall of the secondary piston, and co-operating directly with the ports therein—the secondary and tertiary pistons being adapted to control the inflow to, and outflow from, the combustion chamber without the aid of any intermediate sleeves, springs, or abutments whatever, and "constructed so as to present considerable area to the expansive action of the combustion gases;" and operative connections between the pistons and the crankshaft whereby power is transmitted to the crankshaft.

In the second patent they claim, as an alternative arrangement, the placing of the cylinders side by side, instead of one above the other.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for April 12.]

Nos. 4833—5197.

ALLDAYS AND ONIONS.—"Gas-burners for welding." No. 5172.
BÖLLING, G. H. H.—"Utilization of pitch as fuel." No. 5029.
BROWN, W. H.—"Gas and other stoves." No. 5103.
CHAMBERS, H.—"Cocks." No. 5008.
CLAYTON ANILINE COMPANY.—"Purification of trinitrotoluene." No. 5178.
FARGE, F. C.—"Automatically igniting and extinguishing burners." Nos. 4948 and 5012.
GRANT, R. J.—"Clips for flexible piping." No. 4866.
HALL, I.—"Regulating and controlling temperature." No. 4910.
HARPER, F. D.—"Gas-burners." No. 5096.
HEYL, G. E.—"Distilling coal." No. 5134.
M'GOWAN, R. R.—See Alldays and Onions. No. 5172.
MARCHANT, E. N.—See Clayton Aniline Company. No. 5178.
NEEDHAM, J.—"Gas-mixers." No. 5145.
NICOL, E. W. L.—"Furnaces." No. 5193.
Riter-Conley Manufacturing Company.—"Charging gas-retorts." No. 5128.
SCHEDLER, A.—See Clayton Aniline Company. No. 5178.
WHITE, A. E.—See *Riter-Conley*. No. 5128.

Wellington (N.Z.) Gas Company, Limited.

The forty-sixth annual general meeting of the Company was presided over by Mr. William Ferguson (the Managing-Director), who said that, in common with every other industry, the gas business had been materially affected by the difficulty, and in some cases the inability, to obtain supplies, and the increased cost, as well as by the reduced spending powers of the public, the scarcity of labour, and dearness of money. Notwithstanding these adverse circumstances, however, the working of the year had been on the whole satisfactory. The works at Miramar had been in use during the whole of the year, with good results; but unfortunately, owing to the continued increase in the cost of coal and other materials, and of labour, the savings which had been secured from the adoption of the vertical system of carbonization had been largely absorbed. In spite of the economies gained by the adoption of modern machinery for coal handling, and the abolition of cartage, the increased cost of coal and labour during the past eight years had been such as to amount to a charge of 6d. per 1000 cubic feet of gas sold; and there appeared to be every prospect of a still further increase if the war continued long. Forty of the employees had volunteered for active military service. Owing to the inability of the Company to purchase gas-engines—the British manufacturers being employed in munition work, and therefore unable to fill orders—the management had had to suspend their canvass for engine orders. As the Company themselves manufactured cookers, bath-heaters, washing-coppers, and other gas appliances, the trade in these had not been affected in the same way. The report included the declaration of a dividend for the past half year at the rate of 5 per cent., less income-tax of 2s. 8d. in the pound; and this was much objected to by some shareholders, who carried an amendment that the dividend be paid tax free. A poll was demanded, and at the adjourned meeting it was announced that the amendment had been defeated. It was, however, agreed that the distribution should be in the form of a dividend of 8s. 8d. per share (rather than a dividend of 10s., less 1s. 4d. tax). A proposal by the Board to write-down certain assets was criticized; and there was also much discussion at an extraordinary meeting regarding a revised memorandum and articles of association for the Company.

We learn that Mr. W. H. Rudge, who has been connected with the firm of Fletcher, Russell, and Co., Limited, of Warrington, for over thirty years, has been appointed a Managing-Director of the Company.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bills brought from the Commons, read the first time, and referred to the Examiners: Plymouth and Stonehouse Gas, Uxbridge Gas, Wakefield Corporation Water.

A Select Committee, consisting of Lord M. Bristol (Chairman), Lord E. Harrowby, Lord L. Digby, Lord L. Grimthorpe, Lord L. Weardale, is to meet on Tuesday, the 9th prox., to consider the following Bills: Aberdare and Aberaman Gas, Colchester Gas, Hornsey Gas, Newcastle-upon-Tyne and Gateshead Gas, Yeadon Water.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bills read the third time and passed: Plymouth and Stonehouse Gas, Uxbridge Gas, Wakefield Corporation Water.

Bills reported with amendments: Burnley Corporation Water [Lords], Folkestone Gas.

The South Metropolitan Gas Bill, as amended, was considered, and is to be read the third time.

Local Government Provisional Orders (No. 2) Bill.

A Bill, to confirm certain Provisional Orders of the Local Government Board relating, among others, to the Wath and Bolton Gas Board, was presented last Wednesday by Mr. Hayes Fisher, read the first time, and referred to the Examiners.

Chemical Society—Alien Enemies.

On Wednesday, Mr. R. MCNEILL asked the Prime Minister whether his attention had been called to the report of the Chemical Society for 1915 16, in which it was stated that the Council decided to take no steps to remove the names of alien enemies from the list of honorary and foreign members and Fellows of the Society; whether he was aware that the Chemical Society is constituted by Royal Charter, and occupies premises at Burlington House at the expense of the nation; and whether, in view of the fact that German chemists were responsible for the violations by Germany of the usages of civilized warfare and of international conventions, he would consider the desirability of taking steps to revoke the Charter of the Chemical Society, which retained the names of German chemists on its list of members?

The PRIME MINISTER said that, with regard to the first part of the question, he understood that the matter was still under the Society's consideration. The answer to the second part was in the affirmative, and to the last in the negative.

Restricted Use of Gas and Electricity.

On Thursday, Colonel NORTON-GRIFFITHS asked the Minister of Munitions if he would introduce legislation to limit the use of gas and electricity for lighting purposes after a stated hour, thereby increasing the supply of certain bye-products required for munitions, and also effecting further economies in the use of coal.

Dr. ADDISON replied that the Minister of Munitions did not think that the action suggested would produce the result desired; but he might say that steps had already been taken to ensure that the requirements of munition work should rank before all other considerations in the conduct of both gas and electricity undertakings.

FOLKESTONE GAS BILL.

As reported in the "JOURNAL" last week (p. 92), when this Bill was before the Unopposed Bills Committee of the House of Commons, objection was taken to the fact that a number of the clauses varied from the Model Bill, and, although the preamble was proved, it was arranged that the Model Clauses should be adopted in all cases. The Bill was again before the Committee last Thursday, for a statement by the Parliamentary Agents as to the steps which had been taken to comply with the Committee's decision of the previous week.

Mr. SEDGWICK (Messrs. Rees and Frere, Parliamentary Agents) went through the clauses, with the object of calling the Committee's attention to what had been done. First, clause 27 (the auction clause) had a proviso authorizing the auctioneer to put up several lots of stock at the same time. This has now been taken out. Clause 44, "Power to Create a Special Purposes Fund," also contained a variation from the model by agreement with the Town Clerk of Folkestone. The model form has, however, been inserted. With regard to a number of other slight variations, it was submitted to the Committee that these were in the interest of the consumers. For instance, clause 42, dealing with prepayment meters. The model clause authorizes a gas company to charge 1s. extra per 1000 cubic feet when a prepayment meter is accompanied with fittings and cooking stove; but where the stove is not included, the extra charge is 10d. In the case of Folkestone, however, there is to be a charge of 10d. extra only, whether a stove is included or not. The Committee agreed to this. With regard to the reserve fund (clause 43), a slight variation has been made, providing for this to be placed on deposit at interest with the Company's bankers. The model clause merely states that the fund shall be invested. This amendment, which was granted by the Committee, was allowed in three cases last year and on one occasion this year. The calorific test clause, it was also pointed out, does not precisely follow either of the two forms now regarded more or less as the standard; but it was explained to the Committee that the clause in the form in which it appears has been closely scrutinized by the Local Authority, who have

no objection. The standard calorific power under this clause is 500 B.Th.U.; and the penalties are £2 for a dificiency of 13 B.Th.U., £5 if the deficiency does not exceed 28 B.Th.U., and £10 if the deficiency exceeds 28 B.Th.U.

Mr. MOON, K.C. (Speaker's Counsel), remarked that as the calorific power clauses had not yet stood the test of time, the departure from the usual forms was not serious.

Mr. SEDGWICK also drew attention to an increase in the pressure, which he said is now common. He finally made reference to clause 68, which authorizes the Company, in order to ensure a satisfactory supply of gas, to make specifications of the size and material of pipes, fittings, &c. In the event of the fittings in any premises not complying with this specification, the Company may refuse to supply. The Folkestone Corporation, in the interests of the consumers, thought it would be well to have a proviso compelling the Company to give notice to the consumer immediately after the inspection, and not by subsequent notice, of their intention not to supply in the event of non-compliance with the specification; and an amendment to this effect had been made. To this the Committee agreed.

BURNLEY WATER BILL.

The Unopposed Bills Committee of the House of Commons last Thursday sent this Bill, promoted by the Burnley Corporation, forward for third reading.

An extension of time was asked for in connection with powers granted in 1908 for the construction of water-works and for additional borrowing powers, as follows: Extra expenditure on works already authorized, £103,844; additional works, £42,500; additional lands, £13,000. The first item arose on account of unforeseen difficulties encountered in the construction of the reservoir authorized in 1908, the contract price for which was £215,000. Incidentally it may be mentioned that the contractor went into bankruptcy in consequence. There was at present about £20,000 unexpended borrowing powers of the original capital powers, which the Treasury had agreed should be exhausted. The consent of the Treasury, however, must be obtained before any of the new capital was expended, and it was the intention not to do more than put the works in a safe condition, and to leave further work until after the war, unless, as was not improbable, the demand for more water—already becoming serious—became imperative. At the moment, the compensation water was, by agreement, being used for supply purposes. So far as the new estimates were concerned, however, the figures were based on something approaching an average of pre-war and present prices.

The CHAIRMAN called attention to the fact that the "Navvies" clause was not in the Bill. This gave power for the medical authority of the district in which the works were situate to deal with the hospital arrangements on the spot. In this case, the works were outside the Burnley area, and the Lancashire County Medical Officer of Health would have jurisdiction.

The Burnley Town Clerk gave evidence on the point, and suggested that the Burnley Corporation preferred not to have any outside interference. He explained that there was housing accommodation on the works for some 300 men; but no hospital. The nearest hospital was at Burnley, several miles away, where, however, there was plenty of accommodation.

The COMMITTEE decided that the "Navvies" clause should go into the Bill.

Some discussion took place as to postponing the operation of the sinking fund for five years, having regard to the exceptional circumstances due to the war. As a matter of fact, in the case of the 1908 Act, a similar postponement was allowed; but the hesitation on the part of the Committee now was because there was no precedent for postponing the sinking fund, once the fund had started to operate, as was the case here. With this is bound up the proposal to increase the water-rates from 6 per cent. to 10 per cent.; and it was feared that the postponement of the sinking fund might unnecessarily increase the rates. As a matter of fact, the Corporation had had the right since 1883 to charge on the basis of 6 per cent.; but the rate had remained at 5 per cent. until this year, when an increase to 6 per cent. became imperative. All the neighbouring towns, however, were charging 10 per cent.

The CHAIRMAN, in sanctioning both the postponement of the sinking fund and the increase in charges, said it must be thoroughly well understood that it was due to the exceptional circumstances brought about by the war, and the misfortunes of the Corporation with regard to the completion of the reservoir, with which the Committee fully sympathized.

The Bill has already passed the House of Lords.

Coke-Oven Workers and Air Raids.—The dangerous position of men working at blast-furnaces and coke-ovens during air raids, was commented upon at a meeting of the Cleveland and Durham Blast-Furnacemen's and Cokemen's Association held at Middlesbrough last Wednesday. Mr. Callighan, who presided, said individual firms had undertaken to pay compensation equal to that for ordinary injuries; but as a whole ironmasters had not yet been convinced of the justice of the case. He advised any men not under a definite understanding to take the matter up with their firms, and demand some safeguard. The men should be insured against injury by aircraft. He realized that it was very desirable that the works should be kept going, but questioned whether it was the wisest policy to work at full pressure during the danger hours of night. Had the firms given their serious attention to the provision of shelters for the workmen in the event of raids occurring? He felt that they, as workmen, should know what was the policy of the ironmasters.

Main Munitions.

THE most important munitions in your Summer campaign are Cookers. Every care is exercised in the manufacture of "Main" Cookers so as to ensure their giving the highest possible efficiency. Their range covers all contingencies. There is originality in the treatment of detail consistent with effectiveness and with an eye to economy in replacement. Make them your allies in advancing your summer sales.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

MISCELLANEOUS NEWS.

STOCKPORT GAS MATTERS.

The minutes of the last two meetings of the Stockport Corporation Gas Committee submitted for approval at the monthly meeting of the Town Council showed that further correspondence had passed between Mr. S. Meunier (Gas Engineer) and Mr. P. J. Tevenan (General Secretary of the Municipal Employees' Association), upon matters arising out of the recent award of Mr. Lyndon Macassey, K.C., in connection with the gas-workers' dispute.

The Engineer reported that four firms were taking particulars and preparing a scheme for the concentration of ammoniacal liquor. He had had an interview with a representative of Messrs. Brunner, Mond, and Co., with reference to the installation of the plant and the disposal of the concentrated liquor, with special regard to the taking of the same by the Government. He stated that Messrs. Brunner, Mond, and Co. had suggested that the plant should be so arranged that it could be changed from the concentration of ammoniacal liquor to the making of sulphate of ammonia, and that they also suggested that storage equal to a fortnight's production should be provided. The Gas Committee resolved that a concentration plant be installed, and that the Sub-Committee appointed to consider the matter of the extension of the carbonizing plant be authorized to investigate the specifications, and to accept a tender for the plant.

On the minutes of the Finance Committee for the year 1916-17 being submitted for adoption, it was noticed that the estimates from the trading departments were as follows: Gas, £10,250; tramways, £6250; electricity, £3500, or a total of £20,000. Alderman Graham contended it was not sound business to pay over so large a proportion of gas and electricity profits. It was rather the duty of the Committees to provide their products at the least possible cost to the consumers, than to devote the profits to other things. Alderman Sykes observed that the electricity item had since been reduced by £500 to £3000. He hoped the whole question of relieving the rates at the expense of the trading departments would be taken back for re-consideration. It was important to the welfare of the town that they should be able to give supplies of gas and electricity as extensively as possible at the lowest paying rate. Mr. Henry Bell, D.L. (the Chairman of the Finance Committee), replied that, inasmuch as the credit of the Corporation was pledged in respect of certain borrowings for the works and payment of interest on loans, the ratepayers were entitled to a percentage of the profits; and at a time like the present it was necessary to take money from the profits of the trading departments in order to avoid any increase of rates. This appeal was successful; and the estimates of the Finance Committee were agreed to.

RIPON GAS-WORKS IMPROVEMENTS.

At Ripon, last Wednesday, Mr. A. G. Drury, Local Government Board Inspector, conducted an inquiry into the application by the City Council for sanction to borrow £9000 to carry out improvements at the gas-works. At the meetings of the Council there had been some difference of opinion as to the wisdom or otherwise of going forward with the scheme, and with such divided feeling it was only natural that there should be a large attendance.

The Town Clerk (Mr. M. Kirkley) explained that the application would not have been made in such times as the present, had it been possible to keep the city supplied with gas by the existing plant. It was proposed to erect vertical retorts of a modern kind, by which it was estimated that there would be a considerable saving in wages alone; and that there would be the further advantage of a yield of 12,000 cubic feet of gas per ton of coal, against the 10,000 feet at present. There had been a great influx of residents; and the estimated population was now 12,000, an increase on the last census of nearly 4000. The application, he said, was of vital importance to the city; for unless the powers asked for were obtained, the Council might have to cut off the supply of gas to the military (there is a large camp in the district), for machinery, and for cooking-stoves, and confine it to lighting purposes only.

Mr. Brown (the Chairman of the Gas Committee), in supporting the application, pointed to the position of the city in relation to the gas supply since the advent of the military camp. During the latter part of last year, he said, they were often very short of a proper supply of gas, and were not able to fulfil their obligations to the ratepayers. He felt sure that, unless the new plant was installed for next winter, they would be in a very awkward dilemma, and those using gas for power purposes would not be able to carry on their businesses properly.

Alderman Walker (the Deputy-Chairman) also supported the application. He said everything was satisfactory until the coming of the camp, when, owing to the increased population, and consequent demand for gas, they were placed in a difficult position. This had been made worse by the labour shortage. And, again, the unstable character of the ground of the old retort-house had given repeated trouble during the past eighteen months.

A further witness in support was the Mayor (Mr. Hargrave). Evidence was also given by Mr. W. Doig Gibb, Mr. J. W. Dunn (the Consulting Engineer), and Mr. H. Peeks (the Gas Manager).

The scheme was opposed by Alderman Thirlway, Alderman Fennell, and several councillors, all of whom pleaded that the time was inopportune for such an expenditure of money, and that the existing works could be patched-up until after the war, when prices would be lower, and the time would in every respect be more favourable than the present.

The Inspector afterwards visited the works.

The Scientific Improvement of Cooker Efficiencies

is a subject upon which The Davis Gas Stove Co., Ltd., after 3 years' patient research and careful experimental work in their well-equipped laboratories, may be expected to have an important word to say in due course.

The Gas Exhibition Salons,
60, Oxford St., London, W.

TRIBUNALS AND EXEMPTION APPLICATIONS.

At the West Bromwich Military Tribunal last Tuesday, Mr. W. H. Johns (the Gas Engineer) applied for exemption for an employee engaged on gas-fitting work, who was in Group 32. He explained that certain firms in the town were putting in gas-furnaces, because it was impossible for them to get coal and coke; and without gas-fitters the department could not deal with the applications that were coming in. Before the war, they had 49 men in the gas-fitting branch, and now there were only 29 left. The man in question was not badged, because they were informed by the Ministry of Munitions that it was not necessary to badge these men. Colonel Walker (the Military Representative) remarked that gas-fitting was a certified occupation; but Mr. Johns said a doubt had been raised about this. Seeing that they had already released 50 per cent. of their men for service with the Colours, they felt they had now got down to the "rock bottom." There was an exceptional demand for the fitting-up of gas-furnaces; and they could not put women on this work. Three months' exemption was granted.

An application was made to the Darlington Borough Tribunal for the exemption of two men described as engineer's labourers, in the employ of the Tees Valley Water Board. Replying to a question, Mr. Wilson, on behalf of the Board, said that if the Tribunal would undertake the responsibility of supplying Tees-side with water, he would be glad to let all the men go. Conditional exemption was granted in both cases.

A reservoir keeper in the service of the Bradford Corporation was granted exemption until June 1 by the Oxenhope Tribunal. It was stated that he had also to look after five miles of conduit, including the maintenance of works and property.

At a sitting of the North Riding Appeal Tribunal last Thursday, the Northallerton Gas Company applied for the exemption of an employee who collected the accounts, did clerical work, and assisted the stokers. This was refused.

A GAS-RATE INQUIRY AT ILLINOIS.

Decision of the State Public Utilities Commission.

A copy has been forwarded to us of the official report of a case recently decided by the State Public Utilities Commission of Illinois, the parties to which were the City of Springfield and the Springfield Gas and Electric Company. The matter to be decided was a complaint by the Corporation as to the rates for gas service, and a petition for the determination of "just and reasonable" charges. The Company denied that their rates were unreasonable, and submitted that the schedule in force in Springfield was as low as could be furnished, in justice and equity to both the public and the Company. The following summary of the report has appeared in the pages of American contemporaries.

The State Public Utilities Commission of Illinois have handed down a decision in the largest rate-making procedure before them in the two years of their existence. Gas rates in Springfield (which has a population of 60,000) have been reduced from $1 per 1000 cubic feet to 80 c. net—a reduction of $50,000 annually to the gas consumers. The hearing of the case lasted two years. The present Gas Company in Springfield evolved from the Springfield Gas Light Company, which was granted a Charter by the Legislature of Illinois in 1854. At that time $3·25 per 1000 cubic feet was charged for gas—four times the price now fixed by the Commission. Since 1854, the gas property has grown and changed hands. The greater part of the existing plant seems to have been purchased with earnings from past years, growing from one 60,000 cubic feet holder to four holders totalling 1,345,000 cubic feet capacity. Street-mains have increased from a few blocks to 87 miles in length; and there are over 10,000 services between the street-mains and the consumers' premises. More than 9000 meters are installed. The Company at present manufacture both coal gas and water gas.

In the proceedings before the Commission, five separate valuations of the property were presented—two made by the City of Springfield, two by the Gas Company, and one by the Commission's Engineering staff. All the experts followed different theories; and the values derived by them varied from $500,000 by the city, to $1,200,000 by the Company. The Commission, after thoroughly analyzing the evidence, fixed $800,000 as a fair value of the Springfield gas property for rate-making purposes. One much-debated question was that of land value; and another was that of including or excluding a 1,000,000 cubic feet holder recently erected. The city's experts claimed that the capacity of the holder was excessive; but the Commission found the capacity not unduly large, and allowed proportional value for the holder.

The Company made extensive claims for overhead expenses—that is, items such as (1) engineering during construction, (2) contingencies and incidentals, (3) administration and legal expense, (4) supervision and tools during construction, (5) interest on capital expended during construction, and (6) insurance and taxes—aggregating $178,000. The Commission made no direct finding on this, other than to state that they believed the Company's claims excessive. For working capital and materials and supplies, the Commission allowed $56,000—$30,000 for materials and supplies, and $26,000 for working capital. The Commission discussed depreciation at length; and in their order, made a deduction from "cost new" to cover accrued depreciation. Following a consistent policy, the Commission granted an annual allowance of $15,000 towards a depreciation account as prescribed by the Illinois Statute.

The Commission declare that "there is no proof in the record of the case that the investment necessary to organizing and establishing the business has not been compensated for in rates charged and collected under previous ordinances." After discussing the rate of return, the

"Once Used, Always Used."

ONCE consumers have experienced the pleasures of cooking on a

CARRON

GAS COOKER,

they will have no other.

¶ Owing to the care in their construction, maintenance is practically an unknown quantity. There is, therefore, no worry over parts getting out of order.

¶ CARRON quality, service, and price cannot be improved upon.

No 6D. Gas Cooker Catalogue post free.

CARRON COMPANY Works: CARRON, STIRLINGSHIRE.

And at Phœnix Foundry, Sheffield.

By Appointment Ironfounders to H.M. the King.

Established in the Reign of George II.

finding "as to an equitable rate of return," taking into consideration the nature and inherent risks of the public utility investment in general, and particularly considering all the facts and circumstances relating to this particular gas utility, as well as the testimony regarding the local peculiarities and characteristics of Springfield and its population, is that 7 per cent. per annum is a fair rate of return upon the fair and reasonable value of the active gas property found. At the same time, the Commission point out that 7 per cent. on the entire gas property is equivalent to 10 per cent. return on a proper stock issue, and equal to 15 per cent. on the money actually invested in the property.

For production and operating expenses, the Commission found 50 c. per 1000 feet for equitable rate-making purposes in this particular case. They disallowed the Company's claim for $30,000 to cover expenses of this rate-making procedure, and fixed the standard calorific value of the gas at 600 B.Th.U. per cubic foot, removing the present restriction of 18-candle power gas. The following rates were ordered, effective within thirty days from the date of the order—the 9th inst.:

For the first 10,000 cubic feet per month	$0·80 net
,, ,, next 10,000 ,, ,, ,,	0·75 ,,
,, ,, ,, 30,000 ,, ,, ,,	0·70 ,,
,, ,, ,, 150,000 ,, ,, ,,	0·65 ,,
,, all over 200,000 ,, ,, ,,	0·60 ,,
Minimum bill	0·50 ,,

The Company's present schedule of rates in Springfield is:

Minimum (collected quarterly)	per month	$0·25 net
First 10,000 cubic feet	,,	1·00 ,,
Next 10,000 ,,	,,	0·90 ,,
,, 30,000 ,,	,,	0·80 ,,
,, 50,000 ,,	,,	0·75 ,,
,, 50,000 ,,	,,	0·70 ,,
,, 50,000 ,,	,,	0·65 ,,
Over 200,000 ,,	,,	0·60 ,,

THE GERMAN OCCUPATION OF ANTWERP.

Affairs of the Antwerp Water Company.

Antwerp early in the war suffered bombardment, and the water-works were damaged. The occupation of the city by the Germans followed; and since then the administration of the Water Company and the British shareholders have been entirely cut off from their property and responsibilities in Antwerp.

Reference to the position of affairs, so far as they are known, was made by the Chairman (Mr. George Evans) at the annual meeting of the shareholders on Monday last week. He said that when the shareholders met last year he expressed the hope that the next meeting would be under happier circumstances, and that, if their troubles were not ended, at least the end would be in sight. But the position was still as uncertain as it was then. They were only able to present accounts showing the expenditure in London. The Directors had had no direct communication from Mr. Van der Taalen, the Company's Manager, since his return to Antwerp at the end of 1914. From the slight information that had reached them, they believed that things were going on very quietly in Antwerp; and the Company's undertaking was no doubt under the daily supervision of the Germans. The water supply was, of course, much reduced. Still they understood that the receipts largely exceeded the expenditure; and they believed that a considerable sum had been lodged in a bank at Brussels. But it was, of course, controlled by Germans, and would remain so until the end of the war. Beyond this, he could not say anything. As was foreseen, their securities were insufficient to enable them to keep up the payments on the sinking-fund policies. Consequently, the Directors called a meeting of the debenture holders, and obtained their sanction to a modification of the conditions of the Trust Deed, which was carried out by a supplemental deed. This enabled them to suspend the payment of the premiums; and they also obtained power to borrow, if necessary, against the surrender value of the Sun policy, the money that might be required to meet the interest on the debentures as it fell due. It was, he thought, self-evident that it was quite impossible to continue to repay capital when they had absolutely no income. They had a few securities left; but some had till lately had minimum prices fixed, and were consequently impossible of sale, others for various reasons were unduly depressed, and the Directors thought it wiser not to sacrifice them. Should prices appreciate to any marked extent before July 1, it might be possible to realize them, and so to meet the interest due at that date without having recourse to borrowing. The Imperial Continental Gas Association were responsible for the lighting of Antwerp, as their own Company were for the water supply; and by the courtesy of the Secretary of the Association (who, by special permission of the Government, had been in communication with the Berlin representative of the Association), he was able to give the shareholders the following information regarding the Company's affairs at the end of April last year: "I have just received a letter on the subject of the water-works. The works are perfectly in order again. The damages have all been made good. The cost of repairs will not be so very high, as the work has been done as cheaply as possible. The financial position of the works is very good. I hope to be able to send you, in about a fortnight's time, further particulars." The further particulars had not been received. While they were much indebted to Mr. Wilson for his kindly interest, he (the Chairman) was afraid that the statement that all damages had been repaired was over-sanguine, as they had heard indirectly that repairs to certain parts of the works had certainly not been effected at a much later date. He was doubtful whether they were yet finished, as there must have been a good deal to do. The works were no doubt quite efficient for the supply of the present daily wants, which they were given to understand were about three-fifths of the normal supply previous to the war. He called recently on Mr. Wilson, who told him that the gas-works were being carried on under the same supervision as the water-works, and that he felt confident that any accumulation of

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GAS COOKER.

Where other high-grade Cookers end is the starting point of the "Super-Acme." The "Super-Acme" is not another ordinary Cooker; it is the highest point yet reached in high-grade Gas Cooker Construction.

SOME NOTABLE FEATURES.

Extra large oven.

Hinged and improved hotplate; taps in front; wrought-iron top bars.

Porcelain enamelled inside and out.

Nozzle outlet at back, leaving clear space on top of oven for loose enamelled tray.

All parts are standardized and are not nominally but **actually** interchangeable.

ARDEN HILL & CO.,
"Acme" Works,
BIRMINGHAM.

revenue would be handed back to the legitimate owners at the end of the war. Anything in the nature of prophecy was not of much use; but he did think there was no doubt that the Company would some time come into their own again. But as to what loss they would have sustained, or as to what recompense they would get for the loss sustained, it was as yet impossible to make any statement.

The Directors' report was adopted and other financial business transacted; and, subsequently, at an extraordinary meeting, resolutions were passed making modifications in the Articles of Association.

NOTES FROM SCOTLAND.

Cheap Lamplighters.—The "Glasgow Herald" must be correct in putting the words "Cheap Lamplighters" above this item of news: A donation of one guinea has been made by the Arbroath Town Council to the funds of the local Boy Scouts, who during the past winter have been rendering service as lamplighters.

Air-Raid Warnings in Edinburgh.—On Wednesday last, the Edinburgh Town Council sat in private for the purpose of discussing whether it would be practicable to warn gas consumers of an air-raid by turning off the supply at the works, in much the same way as electricity consumers are warned by the current being so reduced as to cause a dull glow in the lamps. It was, it is understood, pointed out on behalf of the Gas Commission that, while there would be no difficulty in turning off the supply, and that such action would be an effectual warning, air would enter the mains, a dangerous mixture of air and gas would ensue, and explosions, caused by the lighting-back of jets, &c., would take place. It might be possible, however, to give warning, without risk, by reducing the pressure. In view of these opinions, the Council decided to abandon the proposal to cut-off the gas entirely; and it was left to the Gas Commission to carry out experiments in pressure-reduction in some selected district. Failing a satisfactory result, the Committee will consider the advisability of employing sound signals. One town councillor, who favours this method, somewhat astonished his colleagues by quoting, in support of his argument, the first seven verses of the thirty-third chapter of Ezekiel, wherein the blowing of a trumpet by a watchman is advised as a means of warning the people in time of war.

The Crude Benzol Plant at Wombwell.—The Wombwell Urban District Council, who, as recorded in the "JOURNAL" for Feb. 22 last (p. 430), have recently installed a crude benzol plant at their gas-works, have received the following communication from the Ministry of Munitions: "Lord Moulton directs me to refer to the crude benzol plant which has been installed at the Wombwell Gas-Works, and which is yielding such excellent results. He desires me to say that the initiative of your Council is most gratifying, and their practical co-operation testifies to a complete recognition of the national needs."

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *April* 17.

Although the weather recently has not been favourable for the use of tar materials on roads, still delivery of considerable quantities has been taken by local authorities, who evidently think it prudent to have supplies on hand ready for use. Some shipments of pitch continue to be made; and a fair quantity of the material is regularly used for carbonizing purposes. The makers' price for pitch remains at 19s. to 19s. 6d. net per ton at works. The values of other products are unchanged.

Sulphate of ammonia is in an improved position, but is still somewhat stagnant, as shipping facilities are scarce and licences at present, are restricted almost entirely to France. The price of sulphate is nominally unchanged.

Tar Products in the Provinces.

April 17.

There is little alteration in the markets for tar products. No change is reportable in pitch. Creosote is still quiet, and offering at reasonable prices. Solvent naphtha is steady; but there is a fair amount of this article offering. Heavy naphtha is in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¼d. to 2½d. Heavy oils, in bulk, 3¾d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *April* 15.

A certain number of export licences have been issued by the War Trade Department within the past few days, but so far this fact has not made any impression on the market. It is expected that permits will now be given out more freely; but, owing to dearth of tonnage, it will take some time to make up the arrears of shipments. Prompt values are unchanged at £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 2s. 6d. f.o.b. Leith. So far as forward business is concerned, buyers and sellers have both seemed apathetic, and no first transactions have been reported.

"BEARSCOT" SPECIALITIES

Telegrams: "Scrubber, Manchester."

"Have never failed to give Satisfaction."

R. & J. DEMPSTER, Ltd., MANCHESTER.

London Office: 165, GRESHAM HOUSE, Old Broad St., E.C.

Nitrate of Soda.

The tone of this market has continued very firm, and spot quotations have been raised to 17s. 9d. per cwt. for ordinary quality, and to 18s. 9d. for refined.

Sulphate of Ammonia.

From another source it is stated that the prices of this article are as follows: Outside London makes, £15 17s. 6d.; Hull, £16 12s 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade in the north-east is active. The limited supplies, however, barely meet current demands; and the prices for any for early delivery are very firm generally. The steam coal trade shows activity; but there is very little fuel for delivery before the holidays. Best Northumbrian steams are nominally from 40s. to 45s. per ton f.o.b.; second-class steams are 39s. to 40s. per ton; and steam smalls are 21s. to 24s. per ton, with a brisk inquiry. With a heavy demand, added to Government requirements, there is a scarcity of steam coal for this and next week, so that prices are dependent on the delivery that is possible. For next month, prices are less settled, but the production is not likely to be normal even then. In the gas coal trade, the requirements are full, both for home use and export, and Durham coals are firm all round. The long contracts take up much of the output. Best Durham coals are nominally 29s. to 30s. per ton f.o.b.; second-class gas coals are near 28s.; while "Wear Specials" are unaltered. Very little business is doing at these prices—coal for early delivery being only free for sale in small lots. The limited supply for the next week or so has, however, given a little ease to the freight market, and the rate of freight for gas coal, Tyne to London, is now barely 16s., though 38s. has been paid to Rouen. Not much is doing in new contracts for gas coal, though negotiations continue. In coke, exports are heavier—the quantity sent from the Tyne last month, for instance, being double that of the same period of a year ago. Prices are generally firm. Good gas coke is 27s. to 28s. 6d. per ton f.o.b. in the Tyne.

Cost of Electric Power "Alarming."—On it being reported to the Windsor Town Council that at the water-works electric power had been in use during the whole of March, at a cost of £259, Mr. Bond remarked that "the cost of the electric power was becoming alarming." The Mayor (Mr. W. Carter) explained that it was "almost entirely due to the flooded state of the river and the extra cost of fuel due to the war."

Middleton Gas Engineer Complimented.—At the last monthly meeting of the Middleton (Lancs.) Town Council, Alderman Townend, the Chairman of the Gas Committee, in moving the adoption of the minutes, said they were still suffering from a decrease in the make of gas through the cotton mills of the district being on short time. It would be seen from the minutes that the Committee had agreed to advance the salary of the Engineer and Manager (Mr. William Rogerson) as and from April 1 last. The Gas Committee had every confidence in him, and very much appreciated what he had done. He was promised something when he came; and the Committee unanimously agreed to give this advance. Mr. A. Hilton, who seconded, said he was quite in agreement with what Alderman Townend had said with respect to Mr. Rogerson's services. He had done his very best, and was a worthy servant. These were qualities which the Gas Committee desired to acknowledge.

Explosion and Fatal Fire.—An explosion which resulted in a girl 12 years old being burned to death, was inquired into by a Coroner's Jury at Stanley (Durham) last Thursday. John M'Dermott said he complained on the Tuesday of an escape of gas in the house; but this was apparently put right by a fitter, who visited the place and repaired a leak. In the evening, he could smell gas again, and turned it off at the meter. He got up early Wednesday morning to go to work, and still observing the smell of gas did not light a candle. On opening the pantry door, however, there was a violent explosion, and the house immediately caught fire. A police sergeant said he noticed while the fire was in progress reports like gunshots every seven or ten minutes. The man who repaired the leakage in the house stated that Mrs. M'Dermott pointed it out to him, and he did not therefore make a thorough examination of the pipes. Mr. Robert Peart (Acting Manager of the Stanley Gas Company) said since the explosion he had examined the main near the house, and had discovered a leakage. The Jury decided that there was not sufficient evidence to show how the explosion was caused.

Southport Gas Estate and the New Rate.—A special meeting of the Southport Town Council will be held this evening, to levy the rate for 1916-17. In the original estimate, it is understood the Gas Committee offered to contribute £5000 in relief of the rates; but in the statement issued by the Borough Treasurer (Mr. G. Lloyd) the amount is put down at £6000. In consequence, there will be no increase in the rate—a special effort having been made to bring this about. Last year £10,000 was estimated as the contribution of the gas estate; and this amount has been paid over. Mr. Lloyd's statement shows the amount each Committee is paying in consequence of the war. The Gas Committee are paying £375 war allowances to officials and employees serving with the forces; £276 war bonus to employees earning less than 30s. per week; and £317 insurance premiums against damage by aircraft. These payments are in addition to the proposed contribution to the rates. In regard to the estimate for next year's rate, Mr. Lloyd says the Committee's surpluses of last year have been neutralized by (1) the proposal of the Gas Committee to grant the sum of £6000 in aid of the rates, as against £10,000 last year and £14,000 the year before, and (2) an increase on the Water Board's precept for Southport, which is estimated at £15,200, compared with an actual call of £12,754 last year. The new rate will be 5s. 3d. in the pound, with 9d. poor-rate, making in all 6s.

RICHMOND'S
Gas Apparatus

Richmond's new Cooker and Gas Apparatus Booklet.

The above attractive design, printed in rich sepia, forms the cover of our 1916-17 Cooker Booklet, which embodies full particulars of our manufactures.

Supplies will be ready in a few days.

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Remarkable figures of the results obtained from our new "Economic" Cooker will be published shortly.

Dublin Townships' Lighting.—The Rathmines and Pembroke Councils have followed the example of the Dublin Corporation in adopting reduced street lighting—not for military purposes, but on grounds of economy. The arrangements, however, do not apply to main roads.

Charge for Water at Darlington.—At a meeting of the Darlington Town Council recently, when the Mayor was moving a reduced rate, Mr. Best asked why a reduction of charges on water, gas, and electricity could not be made instead of piling on the profits. They were, he said, charging one-third more than was necessary. Alderman Pease, in reply, said that large consumers in Darlington were paying less for their water than any place he knew of in the British Isles.

Tyldesley Gas Committee and a Possible Subsidence of the Works.—At a recent meeting of the Tyldesley Gas Committee, the Gas-Works Sub-Committee stated that, having considered the report of Messrs. Travess and Gale, to the effect that the whole of the gas-works site would be liable to subsidence in future, it was decided to obtain Counsel's opinion as to the position of the gas undertaking in regard to compensation. The opinion referred to has now been received, and is favourable to the Gas Committee. Letters have accordingly been sent to the various collieries, drawing attention to the rights of the Gas Committee.

Modified Lighting Allowances.—The South Metropolitan Gas Company have offered to allow the Lambeth Borough Council a sum of £541 (less 5 per cent.) in respect of the saving represented by burners out of lighting during the Christmas quarter last. The total account for the quarter amounted to £2931. From their account of £518, the Gas Light and Coke Company have offered the Council an allowance of £40; while the South Suburban Gas Company offer a deduction of £33 from their account of £190.

Improved Position at Yorktown.—The improvement which has taken place in the position of the Yorktown and Blackwater Gas Company was indicated by the Chairman (Mr. D. Sparvell, J.P.), at the recent annual meeting, when an increase of over 7 per cent. in the sale of gas was reported, and a dividend at the statutory rate was declared. It was stated that Mr. H. J. Randall (the new Manager) had been with the Company about ten months, and has proved a very competent man. At the meeting a year ago, Mr. R. W. Edwards, of Aldershot, offered some criticism on the accounts then presented; and as a report of what he had to say appeared in the pages of the "JOURNAL," it seems only fair now to record the fact that on the present occasion he congratulated the Company on the balance-sheet presented, and the substantial improvement over 1914 which it revealed.

STOCK MARKET REPORT.

BUSINESS last week on the Stock Exchange continued to be on a quiet scale. The general tone was cheerful and confident, though a market or two here and there was at times affected prejudicially by temporary influences. The gilt-edged division was firm, and the War Loan and Colonial issues were in good demand, though there was more business done in Treasury Bills and Exchequer Bonds. Home Rails were rather irregular and moved but little either way. The incident of the week was the withdrawal of the "Ticket Tax;" but as this result had been largely expected, it did not appear to affect prices. The Foreign Market was not remarkable. The French loan was affected by realizations; and Japanese was dull, though it closed above the worst. Americans were dull; there being too many clouds on their horizon. Canadians were only moderate. Argentines continued depressed by the bad maize harvest and other factors. South Africans were better, though the daily movements were not uniformly upward. Some strange points were furnished in the Miscellaneous Market, where rubbers and oils, banks, and ships all did very well. In the Money Market, there was a strong demand, and rates hardened. The chief topic of the week, of course, was the Budget and its modifications. One point which comes home to the Stock Exchange is that progressive rises in the income-tax promote demand for securities on which the dividends are tax-free. The restrictions upon the issue of capital which are being placed by Parliamentary Committees upon gas companies are attracting serious attention. The question of commissions being shared with Banks is coming up again. Business in the Gas Market quite kept up to recent averages. The general tone was steady; but Gas Light ordinary did better than this, and changed hands at 76½, closing very firm.

Bargains done for cash during the week were as follows: On Monday, Bombay 5⅛, 5¼, European 12 5/16, Gas Light preference 74½, 75, 75¼, Monte Video 8⅜, Primitiva preference 3 9/16, 3⅝, South Metropolitan 75⅜, 76⅛. On Tuesday, Brighton and Hove original 169½, 170½, Commercial 4 per cent. 73, 73¼, Croydon "B" 171½, 172, European 12 5/16, Gas Light preference 75, 75¼, 75⅝, 76. South Metropolitan 76, 76½, South Suburban preference 80¾, 81. On Wednesday, Commercial 3½ per cent. 69½, ditto debentures 55, European 12⅜, 12½, Gas Light ordinary 75¼, 76, ditto maximum 60, 60½, ditto preference 74, Imperial Continental 58, 58½, 58⅜, Primitiva 2, ditto preference 3½, ditto debenture 81½, South Metropolitan 76½. On Thursday, Commercial 3½ per cent. 70½, ditto debenture 55½, Continental Union preference 55, 55¼, 55⅜, European 12 5/16, Gas Light ordinary, 75⅜, 76, 76½, South Suburban debenture 90, 90¼. On Friday, Alliance and Dublin 65 11/16, Gas Light ordinary 76, 76¼, 76½, ditto maximum 60, 61, Primitiva 1 15/16, ditto preference 68s. 9d., 71s. 6d., South Metropolitan 76, 76⅛, 76½, ditto debenture 59½. On Saturday, Buenos Ayres debenture 62½, Oriental 99, South Metropolitan 76.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

The Water Committee of the Nelson Corporation have appointed a Sub-Committee to consider the preliminary steps necessary for the preparation of a new water scheme for the town.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	65 1/16
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅛—6⅜	5 17 8	5⅛—5¼
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
338,110	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	4 5 9	..
153,740	—	—	—	4	Bournemouth Gas and Water: 4 p.c. Deb.	..	—	..
932,045	Stk.	Feb. 26	†14	56/-	Brentford A Consold.	261—266	5 5 3	..
734,920	,,	,,	†11	55/-	Do. B New	204—209	5 5 3	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 3 4	169½—170½
244,200	,,	,,	8	7½	Do. A Ord. Stk.	154—159	5 0 8	..
580,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	62½
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	73—73½
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	69½—70½
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	55—55½
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	55—55⅜
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	171½—172
492,270	Stk.	—	6	5⅝	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,009,180	10	July 29	10	10/-	European, Ltd.	17⅛—18	5 11 1	12 5/16—12 7/16
16,827,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 16 6	75½—76⅛
2,600,000	,,	,,	3½	3½	Gas Light and Coke: 3½ p.c. max.	76—79	4 8 7	60—61
4,062,235	,,	,,	4	4	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	4 0 10	74—76
4,674,850	,,	June 11	3	3	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	4 0 6	..
180,000	,,	,,	10	10	Gas Light and Coke: 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16⅝	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7½	7½	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	58—59¼
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 6	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. {A / B}	211—213 / 146—148	4 18 11 / 4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	8½
1,875,892	Stk.	July 29	4½	4½	Newc'tle & G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/6	North Middlesex 7 p.c.	14—15	5 2 8	..
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	99
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	6 9 0	..
60,000	50	Feb. 26	12	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	1 13/16—2
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4½—5	5 0 0	3 7/16—3⅜
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	81½
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 8	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75⅞—76½
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	59½
224,890	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	80½—81
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	90—90⅝
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham and District: A 5 p.c.	135—138	5 8 8	..
782,275	,,	,,	6	6	Tottenham and District: B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	Tottenham and District: 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	5 7 4	..
80,000	Stk.	Feb. 26	8⅜	78/9	,, B 3½ p.c.	129—134	5 2 7	..
255,636	,,	,,	6⅜	63/9	,, C 3½ p.c.	110—115	5 2 0	..
108,075	,,	,,	5/17/8	55/1½	Wimbledon 5 p.c.	117—122	5 0 5	..
852,000	,,	,,	6½	57/6	Epsom 5 p.c.	121—126	5 5 2	..
98,000	,,	,,	6⅜	63/9	3 p.c. Deb. Stk.	66—69	4 6 11	..
88,416	,,	June 26	3	3				

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Stafford Gas and Water Profits.—It is estimated that out of the profits of the Stafford Gas Department for the past financial year the sum of £1500 will be available in aid of the district fund. The water undertaking will contribute £1000.

Gas-Lamps in Westminster.—At last Thursday's meeting of the Westminster City Council, a letter was received from the Gas Light and Coke Company suggesting that, in view of the great and increasing shortage of labour, the Council should forego the painting of the street lamps and columns this year, and indicating that the Company would be prepared to allow £134 18s. 6d. if this portion of the contract were waived on the present occasion. On the recommendation of the Works Committee, the Council unanimously accepted the offer.

Halifax Gas-Works Extensions.—The Halifax Town Council, at their last monthly meeting, adopted a minute of the Gas Committee which asked for instructions to be given the Engineer (Mr. W. B. M'Lusky) to prepare plans and specifications for replacements required in connection with the horizontal retort-house, and to advertise for tenders for carrying out the work. Similar authority was also given in respect of the erection of part of the coke-loading section of a carbonizing scheme; the Chairman of the Committee (Mr. Waddington) remarking that this was estimated to pay for itself in five years.

Report as to Substituting Gas for Electricity.—The Contracts Committee of the Westminster City Council have notified the receipt of a letter from the St. James's and Pall Mall Electric Light Company, stating that they would be unable to renew their present contract for the supply of electricity to the Council's premises, and would be compelled from June 24 next to invoice the supply for lighting purposes at a charge of 4d. per unit net. The Company did not propose to increase their charge for the supply of current for power purposes. The Committee have instructed the City Engineer to report as to the practicability of substituting gas lighting, and the cost of same, at the Council's premises now lighted by electricity.

The Innovation Light Company, Limited, has been registered, with a capital of £2000 in £1 shares, to carry on the business of manufacturers of gas mantles, lamps, and gas and electrical appliances. The registered office is at No. 146, Bishopsgate, E.C.

At a meeting of the Hebden Bridge Gas Board last Thursday, the Chairman of the Finance Committee alluded to the continued success of the undertaking. The output for the past year, he said, was 116 million cubic feet—a record since the inception of the works.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

PUPIL APPRENTICE. No. 6172.
MANAGER (Coke Oven Plant). No. 6169.
MANAGER (Coke Ovens). Yorkshire Coking and Chemical Company.
SECRETARY. No. 6173.
MANAGER. Brampton Gas-Works.
CARBONIZING FOREMAN. Leeds Gas Department.
RETORT HOUSE FOREMAN. No. 6170.
ERECTOR AND REPAIRER, &c. Desborough Gas-Works.
STOKERS. Nixon's Navigation Company, Mountain Ash.

Agency Wanted.

"TAR." 705, Salisbury House, E.C.

Appointment Wanted.

INSPECTOR AND COLLECTOR (Gas and Water). No. 6171.

Plant, &c. (Second Hand), for Sale.

GAS DRIVEN ELECTRIC STATION PLANT. Leeds Electricity Department.
GASHOLDER AND TANK. Connah's Quay Gas and Water Company.

Meeting.

BOMBAY GAS COMPANY. Moorgate Station Chambers, May 4. Twelve o'clock.

TENDERS FOR

Coal.

BIRKENHEAD CORPORATION. Tenders by May 2.
BLACKPOOL GAS DEPARTMENT.
CALNE GAS COMPANY. Tenders by April 25.
OLDHAM CORPORATION.
ROCHESTER, CHATHAM, AND GILLINGHAM GAS COMPANY. Tenders by April 19.
ULVERSTON GAS AND WATER COMMITTEE. Tenders by April 27.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

EASTER HOLIDAYS.

It is proposed to issue the "JOURNAL" a day later next week—on Wednesday rather than Tuesday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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See Illustrated Advertisement, Feb. 22, p. 440.

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And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

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